APPENDIX D Citizen Participation Plan



Department of Environmental Conservation

Brownfield Cleanup Program

Citizen Participation Plan for Rego Park Center III NYSDEC BCP Site No. C241259

January 2022

C241259 61-10 Junction Boulevard and 93-30 93rd Avenue Rego Park, NY 11374

www.dec.ny.gov

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Note: The information presented in this Citizen Participation Plan was current as of the date of its approval by the New York State Department of Environmental Conservation. Portions of this Citizen Participation Plan may be revised during the site's investigation and cleanup process.

Applicant: Alexander's of Rego Park III, Inc. ("Participant") Site Name: Rego Park Center III ("Site") Site Address: 61-10 Junction Boulevard and 93-30 93rd Avenue Site County: Queens Site Number: C241259

1. What is New York's Brownfield Cleanup Program?

New York's Brownfield Cleanup Program (BCP) works with private developers to encourage the voluntary cleanup of contaminated properties known as "brownfields" so that they can be reused and developed. These uses include recreation, housing, and business.

A *brownfield* is any real property that is difficult to reuse or redevelop because of the presence or potential presence of contamination. A brownfield typically is a former industrial or commercial property where operations may have resulted in environmental contamination. A brownfield can pose environmental, legal, and financial burdens on a community. If a brownfield is not addressed, it can reduce property values in the area and affect economic development of nearby properties.

The BCP is administered by the New York State Department of Environmental Conservation (NYSDEC) which oversees Applicants who conduct brownfield site investigation and cleanup activities. An Applicant is a person who has requested to participate in the BCP and has been accepted by NYSDEC. The BCP contains investigation and cleanup requirements, ensuring that cleanups protect public health and the environment. When NYSDEC certifies that these requirements have been met, the property can be reused or redeveloped for the intended use.

For more information about the BCP, go online at: <u>http://www.dec.ny.gov/chemical/8450.html</u> .

2. Citizen Participation Activities

Why NYSDEC Involves the Public and Why It Is Important

NYSDEC involves the public to improve the process of investigating and cleaning up contaminated sites, and to enable citizens to participate more fully in decisions that affect their health, environment, and social well-being. NYSDEC provides opportunities for citizen involvement and encourages early two-way communication with citizens before decision-makers form or adopt final positions.

Involving citizens affected and interested in site investigation and cleanup programs is important for many reasons. These include:

- Promoting the development of timely, effective site investigation and cleanup programs that protect public health and the environment
- Improving public access to, and understanding of, issues and information related to a particular site and that site's investigation and cleanup process
- Providing citizens with early and continuing opportunities to participate in NYSDEC's site investigation and cleanup process
- Ensuring that NYSDEC makes site investigation and cleanup decisions that benefit from input that reflects the interests and perspectives found within the affected community
- Encouraging dialogue to promote the exchange of information among the affected/interested public, State agencies, and other interested parties that strengthens trust among the parties, increases understanding of site and community issues and concerns, and improves decision-making.

This Citizen Participation (CP) Plan provides information about how NYSDEC will inform and involve the public during the investigation and cleanup of the site identified above. The public information and involvement program will be carried out with assistance, as appropriate, from the Applicant.

Project Contacts

Appendix A identifies NYSDEC project contact(s) to whom the public should address questions or request information about the site's investigation and cleanup program. The public's suggestions about this CP Plan and the CP program for the site are always welcome. Interested people are encouraged to share their ideas and suggestions with the project contacts at any time.

Locations of Reports and Information

The locations of the reports and information related to the site's investigation and cleanup program also are identified in Appendix A. These locations provide convenient access to important project documents for public review and comment. Some documents may be placed on the NYSDEC web-site. If this occurs, NYSDEC will inform the public in fact sheets distributed about the site and by other means, as appropriate.

Site Contact List

Appendix B contains the site contact list. This list has been developed to keep the community informed about, and involved in, the site's investigation and cleanup process. The site contact list will be used periodically to distribute fact sheets that provide updates about the status of the project. These will include notifications of upcoming activities at the site (such as fieldwork), as well as availability of project documents and announcements about public comment periods. The site contact list includes, at a minimum:

- Chief executive officer and planning board chairperson of each county, city, town, and village in which the site is located;
- Residents, owners, and occupants of the site and properties adjacent to the site;
- The public water supplier which services the area in which the site is located;
- Any person who has requested to be placed on the site contact list;
- The administrator of any school or day care facility located on or near the site for purposes of posting and/or dissemination of information at the facility;
- Location(s) of reports and information.

The site contact list will be reviewed periodically and updated as appropriate. Individuals and organizations will be added to the site contact list upon request. Such requests should be submitted to the NYSDEC project contact(s) identified in Appendix A. Other additions to the site contact list may be made at the discretion of the NYSDEC project manager, in consultation with other NYSDEC staff as appropriate.

Note: The first site fact sheet (usually related to the draft Remedial Investigation Work Plan) is distributed both by paper mailing through the postal service and through DEC Delivers, its email listserv service. The fact sheet includes instructions for signing up with the appropriate county listserv to receive future notifications about the site. See http://www.dec.ny.gov/chemical/61092.html.

Subsequent fact sheets about the site will be distributed exclusively through the listserv, except for households without internet access that have indicated the need to continue to receive site information in paper form. Please advise the NYSDEC site project manager identified in Appendix A if that is the case. Paper mailings may continue during the investigation and cleanup process for some sites, based on public interest and need.

CP Activities

The table at the end of this section identifies the CP activities, at a minimum, that have been and will be conducted during the site's investigation and cleanup program. The flowchart in Appendix D shows how these CP activities integrate with the site investigation and cleanup process. The public is informed about these CP activities through fact sheets and notices distributed at significant points during the program. Elements of the investigation and cleanup process that match up with the CP activities are explained briefly in Section 5.

- Notices and fact sheets help the interested and affected public to understand contamination issues related to a site, and the nature and progress of efforts to investigate and clean up a site.
- Public forums, comment periods and contact with project managers provide opportunities for the public to contribute information, opinions and perspectives that have potential to influence decisions about a site's investigation and cleanup.

The public is encouraged to contact project staff at any time during the site's investigation and cleanup process with questions, comments, or requests for information.

This CP Plan may be revised due to changes in major issues of public concern identified in Section 3 or in the nature and scope of investigation and cleanup activities. Modifications may include additions to the site contact list and changes in planned citizen participation activities.

Technical Assistance Grant

NYSDEC must determine if the site poses a significant threat to public health or the environment. This determination generally is made using information developed during the investigation of the site, as described in Section 5.

If the site is determined to be a significant threat, a qualifying community group may apply for a Technical Assistance Grant (TAG). The purpose of a TAG is to provide funds to the qualifying group to obtain independent technical assistance. This assistance helps the TAG recipient to interpret and understand existing environmental information about the nature and extent of contamination related to the site and the development/implementation of a remedy. An eligible community group must certify that its membership represents the interests of the community affected by the site, and that its members' health, economic wellbeing, or enjoyment of the environment may be affected by a release or threatened release of contamination at the site.

As of the date the declaration (page 2) was signed by the NYSDEC project manager, the significant threat determination for the site had not yet been made.

To verify the significant threat status of the site, the interested public may contact the NYSDEC project manager identified in Appendix A.

For more information about TAGs, go online at <u>http://www.dec.ny.gov/regulations/2590.html</u>

Note: The table identifying the citizen participation activities related to the site's investigation and cleanup program follows on the next page:

Citizen Participation Activities	Timing of CP Activity(ies)				
Application Process:					
Prepare site contact list	At time of preparation of application to participate in the BCP.				
Establish document repository(ies)					
 Publish notice in Environmental Notice Bulletin (ENB) announcing receipt of application and 30-day public comment period Publish above ENB content in local newspaper Mail above ENB content to site contact list Conduct 30-day public comment period 	When NYSDEC determines that BCP application is complete. The 30-day public comment period begins on date of publication of notice in ENB. End date of public comment period is as stated in ENB notice. Therefore, ENB notice, newspaper notice, and notice to the site contact list should be provided to the public at the same time.				
After Execution of Brownfield Site Cleanup Agreement (BCA):					
Prepare Citizen Participation (CP) Plan	Before start of Remedial Investigation Note: Applicant must submit CP Plan to NYSDEC for review and approval within 20 days of the effective date of the BCA.				
Before NYSDEC Approves Remedial Investigation (RI) Work Plan:					
 Distribute fact sheet to site contact list about proposed RI activities and announcing 30-day public comment period about draft RI Work Plan Conduct 30-day public comment period 	Before NYSDEC approves RI Work Plan. If RI Work Plan is submitted with application, public comment periods will be combined and public notice will include fact sheet. Thirty-day public comment period begins/ends as per dates identified in fact sheet.				
After Applicant Completes Remedial Investigation:					
Distribute fact sheet to site contact list that describes RI results	Before NYSDEC approves RI Report				
Before NYSDEC Approves Remedial Work Plan (RWP):					
 Distribute fact sheet to site contact list about draft RWP and announcing 45-day public comment period Public meeting by NYSDEC about proposed RWP (if requested by affected community or at discretion of NYSDEC project manager) Conduct 45-day public comment period 	Before NYSDEC approves RWP. Forty-five day public comment period begins/ends as per dates identified in fact sheet. Public meeting would be held within the 45-day public comment period.				
Before Applicant Starts Cleanup Action:					
 Distribute fact sheet to site contact list that describes upcoming cleanup action 	Before the start of cleanup action.				
After Applicant Completes Cleanup Action:					
 Distribute fact sheet to site contact list that announces that cleanup action has been completed and that NYSDEC is reviewing the Final Engineering Report Distribute fact sheet to site contact list announcing NYSDEC approval of Final Engineering Report and issuance of Certificate of Completion (COC) 	At the time the cleanup action has been completed. Note: The two fact sheets are combined when possible if there is not a delay in issuing the COC.				

3. Major Issues of Public Concern

This section of the CP Plan identifies major issues of public concern that relate to the site. Additional major issues of public concern may be identified during the course of the site's investigation and cleanup process.

The following major issues of public concern were identified: air quality, health of workers and community, nuisance odors, noise, and construction-related traffic. These issues are of most concern to adjacent property owners, residents, and businesses, and site workers. These issues will be addressed in the Remedial Investigation (RI) Work Plan, Remedial Work Plan (RWP), Community Air Monitoring Program (CAMP), site-specific Health and Safety Plan (HASP) and Construction HASP (CHASP) for the project. These documents will undergo public notice and are subject to approval by the NYSDEC and the New York State Department of Health (NYSDOH) prior to work being performed.

The Site is located in an Environmental Justice Area. Environmental justice is defined as the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies.

Environmental justice efforts focus on improving the environment in communities, specifically minority and low-income communities, and addressing disproportionate adverse environmental impacts that may exist in those communities.

The Site is located in an area with a sizable Asian-American (Chinese and Indian) population nearby. Therefore all future fact sheets will be translated into Chinese and Hindi.

For additional information, visit:

https://statisticalatlas.com/tract/New-York/Queens-County/071702/Overview

Based on previous investigations, historical operations at the brownfield site included a gasoline filling station on the northwestern corner of current Lot 98 (1950) and commercial truck repair (1981 through early 2000s) and a vehicle repair shop (1995) on the northeastern portion of Lot 50. Contaminants of concern are petroleum and metals, including concentrations of lead that exceed the United States Environmental Protection Agency (USEPA) Hazardous Waste Limit (HWL) in soil. Potential associated petroleum and metals impacts to groundwater will be evaluated during a Remedial Investigation. The identified contaminants will be assessed, delineated, and remediated in accordance with NYSDEC-approved work plans.

Site information is available through Project Contacts mentioned in Section 2 and Appendix A. The BCP Application, which includes the previous site investigations and identifies future reports that will be prepared for the NYSDEC, is available in the document repository discussed above in Section 2 and in Appendix A. The RI Work Plan and RWP will include schedules for planned work.

4. Site Information

Appendix C contains a map identifying the location of the site.

Site Description

The site is approximately 141,570 square feet (3.25 acres) in area and is located at 61-10 Junction Boulevard and 93-30 93rd Avenue in Rego Park, NY. The site is identified as Block 2076, Lots 50 and 63; Block 2077, Lots 90 and 98; the de-mapped former 94th Place; and a de-mapped section of 62nd Avenue on the Queens Borough Tax Map. Merger of the proposed BCP site into a single lot with metes and bounds that correspond to the proposed site boundaries is pending. The site is currently used as a private parking lot, with the exception of a portion of Lot 50 and the de-mapped portion of 62nd Avenue, which are used as a vehicle turning bay at the eastern terminus of 62nd Avenue.

The site is located in an area generally characterized by commercial and industrial buildings, but also includes residential buildings, public parks, day care centers, and schools. The site is bound by the Horace Harding Expressway to the north, Junction Boulevard followed by a mixed-use residential and commercial use building to the east, 62nd Avenue and the Lost Battalion Hall Playground to the south, and 93rd Street followed by mixed-use residential buildings and parking lots to the west

According to a 2016 survey prepared by Montrose Surveying Co. LLP, the site grade ranges from elevation (el) 16 to el 20 feet referenced to the North American Vertical Datum of 1988 (NAVD88). The topography of the site and surrounding area is generally level with a regional topographic gradient downward towards the east.

According to the New York City Planning Commission Zoning Map 14a, the site is located within a residential district (R8) with a commercial overlay (C2-2); however, the site is subject to a reverter provision contained in a 1986 restrictive declaration, whereby it is subject to the regulations applicable in an R7-1/C2-2 district. R7-1 districts are medium-density apartment house districts. C2-2 districts are commercial overlays mapped within residence districts. Mapped along streets that serve local retail needs, they are located throughout lower- and medium-density areas and occasionally in higher-density districts.

History of Site Use, Investigation, and Cleanup

The site and surrounding area are located in an urban setting historically characterized by commercial, and industrial development. Historical operations at the brownfield site include a gasoline filling station on the northwestern corner of current Lot 98 (1950) and a commercial trucking facility (1981 to early 2000s) and a vehicle repair shop (1995) on the northeastern portion of current Lot 50. Evidence of commercial truck repair operations was documented near the former vehicle repair shop in 2002.

Previously, the site was the subject of a Phase I Environmental Site Assessment (ESA) and several subsurface investigations, which are documented in the following reports:

- September 1994 Evaluation of Existing Parking Lot Fill, prepared by Langan Engineering and Environmental Services, P.C. (Langan)
- April 30, 2003 Phase I ESA, prepared by AKRF, Inc. (AKRF)
- March 5, 2004 Phase II ESA, prepared by Roux Associates, Inc. (Roux)
- March 6, 2012 Supplemental Phase II ESA, prepared by Roux
- October 19, 2021 Supplemental Subsurface Investigation by Langan

The following is a summary of each report listed above:

September 1994 Evaluation of Existing Parking Lot Fill, by Langan

Langan completed an evaluation of subsurface conditions at the site as part of a larger investigation that included the property located to the southeast (Block 2084, Lot 101), which is currently occupied by the Rego Center Shopping Mall. Five of the 71 soil borings advanced during the investigation were located on Block 2076, Lot 50 and Block 2077, Lot 98. Total Petroleum Hydrocarbons (TPH) were identified in soil samples throughout the site at concentrations above 1,000 parts per million (ppm). Lead analyzed via Toxicity Characteristic Leaching Procedure (TCLP) was identified on the southeast part of Lot 98 at a concentration of 9.4 milligrams per liter (mg/L), which exceeds USEPA HWL of 5.0 mg/L.

April 30, 2003 Phase I ESA, prepared by AKRF

AKRF prepared a Phase I ESA in April 2003 in accordance with ASTM E1527-00 for Block 2076, Lot 50 and Block 2077, Lot 98. At the time of the Phase I ESA, the site was an asphalt-paved parking lot. The following Recognized Environmental Conditions (RECs) were identified:

- Documented evidence of TPH and TCLP lead contamination, as identified in the above-referenced 1994 Evaluation of Existing Parking Lot Fill.
- Operation of a vehicle maintenance garage in a one-story building in the northeast part of Lot 50.
- Historical operation of a gasoline filling station on the northwest corner of Lot 98 (1950), and a vehicle repair facility in the northeast corner of Lot 50 (1995).
- Historical off-site operation of a sewer disposal plant (1914 to 1950) and removal of a leaking underground storage tank (UST) on the southern adjoining property.

The Phase I ESA also noted documented active commercial trucking storage and maintenance operations on the central and northeastern portions of Lot 50. The one-story former vehicle repair facility was vacant at the time of the site reconnaissance.

March 5, 2004 Phase II ESA, prepared by Roux

Roux completed a Phase II ESA in March 2004 to investigate RECs identified in the April 2003 Phase I ESA. The Phase II investigation included a geophysical survey, advancement of eight soil borings, collection of soil samples, and collection of groundwater samples from five monitoring wells. Field observations and laboratory analytical results are summarized below:

- <u>Geophysical Survey</u>: Two anomalies indicative of underground storage tanks (USTs) were identified about 40 feet east of the former vehicle repair facility (Lot 50).
- <u>Soil</u>: Lead was detected above Title 6 of the New York Codes, Rules and Regulations (6 NYCRR) Part 375 Restricted Use Restricted-Residential (RURR) Soil Cleanup Objectives (SCOs) in two soil samples collected from the eastern portion of the site. TCLP lead exceeding the USEPA HWL was identified at one location in the southeast part of the site at a concentration of 17.4 mg/L. VOCs were not detected above the RURR SCOs.
- <u>Groundwater</u>: Lead was detected in two unfiltered groundwater samples at concentrations above the NYSDEC Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs) for Class GA groundwater.

March 6, 2012 Supplemental Phase II ESA

Roux completed a Supplemental Phase II ESA in March 2012 to investigate RECs identified in the April 2003 Phase I ESA and to further investigate findings from the March 2004 Phase II ESA. The Supplemental Phase II investigation included a test pit excavation, and collection of soil samples from eight soil borings. Field observations and laboratory analytical results are summarized below:

- <u>Site Geology and Hydrogeology</u>: Soil borings exhibited non-native fill consisting of gray to dark-brown, fine to coarse sand, and gravel, with some silt, brick, glass, and wood fragments. Fill material was identified at the terminal depth of the borings, which extended to about 15 feet below ground surface (bgs). Groundwater was identified between 11 and 15 feet bgs and was inferred to flow towards the southeast.
- <u>Field Observations</u>: Organic vapors of up to 406 ppm and a "chemically treated wood odor" were observed in soil between about 10 and 15 feet bgs in a boring advanced on the southeastern portion of the site on Lot 98. Organic vapors of up to 15.6 and 45.2 ppm were also observed in soil between 9 and 14 feet bgs (RA-13) and between 1 and 12 feet bgs (RA-16), respectively, on the western portion of the site (Lot 50). A test pit was excavated to expose the suspected USTs identified in the 2004 Phase II ESA on Lot 50; however, the excavation was abandoned at about 1 foot bgs due to water infiltration. Odors, organic vapor concentrations of up to 6.5 ppm, and vehicle parts, oil filters, and other debris associated with historical vehicle repair operations were observed in the excavation.
- <u>Soil</u>: Four metals, including barium, lead, copper, and mercury, exceeded the RURR SCOs in five locations throughout the site. TCLP lead was identified at two locations in the southwest and northwest portions of Lot 50 at concentrations of 29 mg/L and 32.7 mg/L, respectively, which exceed the USEPA HWL. Two pesticides, including 4'4'-DDD and 4'4'-DDE, exceeded the RURR SCOs between 1 to 3 feet bgs in the central portion of Lot 98.

October 19, 2021 Supplemental Subsurface Investigation, prepared by Langan

Langan prepared a technical memorandum summarizing a supplemental subsurface investigation (SSI) conducted on behalf of Alexander's of Rego Park III, Inc. The SSI was performed to supplement the BCP application that was submitted to NYSDEC on July 9, 2021. The SSI included a geophysical survey of accessible areas throughout the site, advancement of 12 soil borings to about 12 feet bgs, and collection of 9 soil samples for

analysis of VOCs, semi-volatile organic compounds (SVOCs), and metals. Field observations and laboratory analytical results are summarized below:

- <u>Geophysical Survey</u>: An approximately 8-foot by 15-foot geophysical anomaly resembling a potential UST was identified in the northern part of the site. An anomaly indicative of a fuel fill port was identified in the northern sidewalk and connected to a buried pipe that extended about 50 feet southward onto the site before terminating about 30 feet east of the apparent UST.
- <u>Field Observations</u>: Historic fill was observed beneath the 3- to 4-inch-thick asphalt surface cover extending to depths between about 2 and 12 feet bgs. The fill primarily consists of brown, fine- to medium-grained sand with varying amounts of slag, metal, wood, clay, silt, gravel, concrete, brick, and coal. Native soil observed in eight borings consisted of fine- to medium-grained sand with varying amounts of gravel, clay, and silt. Apparent groundwater was observed between about 11 and 12 feet bgs. Soil recovered from nine borings exhibited indications of petroleum impacts, based on staining, odors, and/or PID readings up to 50 ppm above background.
- <u>Soil</u>: SVOCs were detected above the RURR SCOs in two soil samples collected from two borings, and copper and lead were detected above the RURR SCOs in two soil samples collected from one boring.

5. Investigation and Cleanup Process

Application

The Applicant has applied for and been accepted into New York's Brownfield Cleanup Program as a Participant. This means that the Applicant was the owner of the site at the time of the disposal or discharge of contaminants or was otherwise liable for the disposal or discharge of the contaminants. The Participant must fully characterize the nature and extent of contamination onsite, as well as the nature and extent of contamination that has migrated from the site. The Participant also must conduct a "qualitative exposure assessment," a process that characterizes the actual or potential exposures of people, fish, and wildlife to contaminants on the site and to contamination that has migrated from the site.

The Applicant in its Application proposes that the site will be used for mixed-use commercial and residential purposes.

To achieve this goal, the Applicant will conduct investigation and cleanup activities at the site with oversight provided by NYSDEC. The Brownfield Cleanup Agreement executed by

NYSDEC and the Applicant sets forth the responsibilities of each party in conducting these activities at the site.

Investigation

The Applicant has completed a partial site investigation before it entered into the BCP. NYSDEC will determine if the data is useable.

The Applicant will conduct an investigation of the site officially called a "remedial investigation" (RI). This investigation will be performed with NYSDEC oversight. The Applicant developed a remedial investigation work plan, which is subject to public comment.

The site investigation has several goals:

- define the nature and extent of contamination in soil, surface water, groundwater and any other parts of the environment that may be affected;
- 2) identify the source(s) of the contamination;
- 3) assess the impact of the contamination on public health and the environment; and
- provide information to support the development of a proposed remedy to address the contamination or the determination that cleanup is not necessary.

The Applicant submitted a draft RI Work Plan to NYSDEC for review and approval concurrently with the BCP Application. The RI Work Plan is currently under review by NYSDEC.

When the investigation is complete, the Applicant will prepare and submit a report that summarizes the results. This report also will recommend whether cleanup action is needed to address site-related contamination. The investigation report is subject to review and approval by NYSDEC.

NYSDEC will use the information in the investigation report to determine if the site poses a significant threat to public health or the environment. If the site is a "significant threat," it must be cleaned up using a remedy selected by NYSDEC from an analysis of alternatives prepared by the Applicant and approved by NYSDEC. If the site does not pose a significant threat, the Applicant may select the remedy from the approved analysis of alternatives.

Interim Remedial Measures

An Interim Remedial Measure (IRM) is an action that can be undertaken at a site when a source of contamination or exposure pathway can be effectively addressed before the site investigation and analysis of alternatives are completed. If an IRM is likely to represent all or a significant part of the final remedy, NYSDEC will require a 30-day public comment period.

Remedy Selection

When the investigation of the site has been determined to be complete, the project likely would proceed in one of two directions:

1. The Applicant may recommend in its investigation report that no action is necessary at the site. In this case, NYSDEC would make the investigation report available for public comment for 45 days. NYSDEC then would complete its review, make any necessary revisions, and, if appropriate, approve the investigation report. NYSDEC would then issue a "Certificate of Completion" (described below) to the Applicant.

or

2. The Applicant may recommend in its investigation report that action needs to be taken to address site contamination. After NYSDEC approves the investigation report, the Applicant may then develop a cleanup plan, officially called a "Remedial Work Plan". The RWP describes the Applicant's proposed remedy for addressing contamination related to the site.

When the Applicant submits a draft RWP for approval, NYSDEC would announce the availability of the draft plan for public review during a 45-day public comment period.

Cleanup Action

NYSDEC will consider public comments, and revise the draft cleanup plan if necessary, before approving the proposed remedy. The New York State Department of Health (NYSDOH) must concur with the proposed remedy. After approval, the proposed remedy becomes the selected remedy. The selected remedy is formalized in the site Decision Document.

The Applicant may then design and perform the cleanup action to address the site contamination. NYSDEC and NYSDOH oversee the activities. When the Applicant

completes cleanup activities, it will prepare a final engineering report that certifies that cleanup requirements have been achieved or will be achieved within a specific time frame. NYSDEC will review the report to be certain that the cleanup is protective of public health and the environment for the intended use of the site.

Certificate of Completion

When NYSDEC is satisfied that cleanup requirements have been achieved or will be achieved for the site, it will approve the final engineering report. NYSDEC then will issue a Certificate of Completion (COC) to the Applicant. The COC states that cleanup goals have been achieved, and relieves the Applicant from future liability for site-related contamination, subject to certain conditions. The Applicant would be eligible to redevelop the site after it receives a COC.

Site Management

The purpose of site management is to ensure the safe reuse of the property if contamination will remain in place. Site management is the last phase of the site cleanup program. This phase begins when the COC is issued. Site management incorporates any institutional and engineering controls required to ensure that the remedy implemented for the site remains protective of public health and the environment. All significant activities are detailed in a Site Management Plan (SMP).

An *institutional control* is a non-physical restriction on use of the site, such as a deed restriction that would prevent or restrict certain uses of the property. An institutional control may be used when the cleanup action leaves some contamination that makes the site suitable for some, but not all uses.

An *engineering control* is a physical barrier or method to manage contamination. Examples include caps, covers, barriers, fences, and treatment of water supplies.

Site management also may include the operation and maintenance of a component of the remedy, such as a system that pumps and treats groundwater. Site management continues until NYSDEC determines that it is no longer needed.

Appendix A -Project Contacts and Locations of Reports and Information

Project Contacts

For information about the site's investigation and cleanup program, the public may contact any of the following project staff:

New York State Department of Environmental Conservation (NYSDEC):

Sadique Ahmed Project Manager NYSDEC Division of Environmental Remediation 625 Broadway, Albany, NY 12233-7016 Tel: 518-402-9767 Email: sadique.ahmed@dec.ny.gov

Thomas V. Panzone Public Participation Specialist NYSDEC Office of Communications Services 47-40 21st Street Long Island City, NY 11101 Tel: 718-482-4953 Email: thomas.panzone@dec.ny.gov

New York State Department of Health (NYSDOH):

Gregory Rys Public Health Specialist NYSDOH 5665 NYS Route 5 Herkimer, NY 13350 Tel: 315 619 3194 Email: BEEI@health.ny.gov

Locations of Reports and Information

The facilities identified below are being used to provide the public with convenient access to important project documents:

DEC Info Locator:

https://www.dec.ny.gov/pubs/109457.html

Queens Public Library at Rego Park

91-41 63rd Drive, Rego Park, NY 11374 (718) 459-5140

Queens Community Board 6

104-01 Metropolitan Ave. Forest Hills, NY 11375 Attn: Alexa Weitzman, Chairperson Frank P. Gulluscio, District Manager Alexander Cohen, Environmental Protection Committee Chairperson

Phone: (718) 263-9250 Email: qn06@cb.nyc.gov Hours: Monday through Friday 9am-5pm (call for appointment)

Note: Repositories may be temporarily unavailable due to COVID-19 precautions. If you cannot access the online repository, please contact the NYSDEC project manager listed below for assistance:

Sadique Ahmed

Project Manager NYSDEC Division of Environmental Remediation 625 Broadway, Albany, NY 12233-7016 Tel: 518-402-9767 Email: sadique.ahmed@dec.ny.gov

Appendix B - Site Contact List

Chief Executive Officer Mayor Eric Adams City Hall New York, NY 10007

Hon. Donovan Richards Queens Borough President 120-55 Queens Boulevard Kew Gardens, NY 11424

Hon. Brad Lander NYC Comptroller 1 Centre Street New York, NY 10007

Hon. Jumaane Williams Public Advocate 1 Centre Street New York, NY 10007

Mark McIntyre, Acting Director/General Counsel NYC Office of Environmental Remediation 100 Gold Street - 2nd Floor New York, NY 10038

Anita Laremont, Commissioner New York City Department of City Planning 120 Broadway, 31st Floor New York, NY 10271

Vicky Garvey Acting Director of Planning & Development 120-55 Queens Boulevard Kew Gardens, New York 11424 Audrey I. Pheffer Queens County Clerk 88-11 Sutphin Blvd #106 Jamaica, NY 11435

Hon Charles Schumer U.S. Senator 780 Third Avenue, Suite 2301 New York, NY 10017

Hon. Kirsten Gillibrand U.S. Senator 780 Third Avenue, Suite 2601 New York, NY 10017

Hon. Grace Meng U.S. House of Representatives 118-35 Queens Boulevard, Suite 1610 Forest Hills, NY 11375

Hon. Lynn Schulman NYC Councilmember 118-35 Queens Boulevard, 17th Floor Forest Hills, NY 11375

Hon. Toby Stavisky NYS Senator 142-29 37th Ave Suite 1 Flushing, NY 11354

Hon. Andrew Hevesi NYS Assemblymember 70-50 Austin Street, Suite 118 Forest Hills, NY 11375

Residents, owners, and occupants of the site and properties adjacent to the site

Adjacent properties include:

Rego Center Shopping Mall 61-01 Junction Blvd, Rego Park, NY 11374 Owner: Alexander's Rego Shopping Center, Inc. C/o Vornado Realty Trust 888 Seventh Avenue, New York, NY 10019 212-894-7000 Lost Battalion Hall Recreation Center Attn: Center Manager 93-29 Queens Boulevard Rego Park, NY 11374

94-05 Queens Boulevard Rego Park, NY 11374 Owner: AT&T 1 Rockefeller Plaza New York, NY 10020

92-73 93rd St Rego Park, NY 11374 Owner: Andon Investment Ltd. c/o Arma Andon PO Box 1267, West Hampton Beach New York, 11978

92-15 62nd Avenue Rego Park, NY 11374 Owner: Creative Foods Corp. 200 Garden City Plaza #105, Garden City, NY 11530 94-30 Horace Harding Expressway Rego Park, NY 11374 Owner: 94-10 Realty LLC. 94-10 60th Avenue Elmhurst, NY 11373

92-63 Queens Blvd, Rego Park, NY 11374 Owner: P.C. Richard & Son 150 Price Parkway, Farmingdale, NY 11735

Local news media from which the community typically obtains information

New York Daily News 4 New York Plaza New York, NY 10004

New York Post 1211 Avenue of the Americas New York, NY 10036

Spectrum NY 1 News 75 Ninth Avenue New York, NY 10011

QNS (Schneps Media) 38-15 Bell Boulevard Bayside, NY 11361 (718) 224-5863

Forest Hills Times 45-23 47th Street Woodside, NY 11377 (718) 639-7000

World Journal (Chinese) 141-07 20th Avenue Whitestone, NY 11357

India Abroad 2 Tower Center Boulevard - 8th Floor East Brunswick, NJ 08816

Public Water Supplier

The responsibility for supplying water in New York City is shared between the NYC Department of Environmental Protection, the Municipal Water Finance Authority, and the New York City Water Board:

NYCDEP Vincent Sapienza Commissioner 59-17 Junction Boulevard Flushing, NY 11373

New York City Municipal Water Finance Authority 255 Greenwich Street, 6th Floor New York, NY 10007

New York City Water Board NYC Department of Environmental Protection 59-17 Junction Boulevard, 8th Floor Flushing, NY 11373

Community, Civic, Religious and Other Environmental Organizations:

Consolidated Edison Corporate Affairs Richard David 59-17 Junction Boulevard – 2nd Floor Elmhurst, NY 11373

Heidi Harrison Chain - President 112th Precinct Community Council 68-40 Austin Street, Forest Hills, NY 11375

Battalion 46 Engine 287 Ladder 136 86-53 Grand Avenue Elmhurst, NY 11373

Queens Community House - Forest Hills Community Center 108-25 62nd Drive Forest Hills, NY 11375 (718) 592-5757 https://www.qchnyc.org/contact

Rego Park Neighborhood Senior Center Attn: Executive Director 93-29 Queens Boulevard Rego Park, NY 11374

Schools and Day Care Facilities

There are no schools or day care facilities located on the site. The following are schools or day care facilities located within 1/2 mile of the site:

P.S. 139 Rego Park Attn:: President/Executive Director/Principal 93-06 63rd Drive Rego Park, NY 11374 Phone: (718) 459-1044

Sholom Learning Center - Daycare Attn:: President/Executive Director/Principal 63-44 Wetherole Street Rego Park, NY 11374 Phone: (718) 896-5437 https://sholomdaycare.com/contact-us/

All My Children Daycare & Nursery School Attn:: President/Executive Director/Principal 97-30 Queens Blvd Rego Park, NY 11374 Phone: (718) 275-6300 https://allmychildrendaycare.com/locations/queens-locations/

MetroKids Preschool Attn:: President/Executive Director/Principal 63-47 Booth St Rego Park, NY 11374 Phone: (718) 896-8108

Nelia's Day Care Attn:: President/Executive Director/Principal 97-07 63rd Road, 3E Rego Park, NY 11374 Phone: (718) 564-3038

PS 206 Horace Harding Attn:: President/Executive Director/Principal 61-02 98th Street Rego Park, NY 11374

Jewish Institute of Queens Attn:: President/Executive Director/Principal 60-05 Woodhaven Boulevard Elmhurst, NY 11373 PS 013 Clement C Moore Attn:: President/Executive Director/Principal 55-01 94th Street Elmhurst, NY 11373

Sesame Sprout, Inc. Attn:: President/Executive Director/Principal 95-15 Horace Harding Expressway Corona, NY 11368

Happy Dragon of USA, Inc. Attn:: President/Executive Director/Principal 98-25 Horace Harding Expressway Corona, NY 11368

ICCD Attn:: President/Executive Director/Principal 98-02 62nd Drive Rego Park, NY 11374 https://www.iccd.com/locations

A & A Kathy's Day Care, Inc. Attn:: President/Executive Director/Principal 94-25 57 Ave Elmhurst, NY 11373





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mal engineer, land surveyor or geologist, to after this item in any way.

Appendix D– Brownfield Cleanup Program Process





Division of Environmental Remediation

Remedial Programs Scoping Sheet for Major Issues of Public Concern

Site Name: Rego Park Center III

Site Number: C241259

Site Address and County: 61-10 Junction Boulevard and 93-30 93rd Avenue, Rego Park, New York

Remedial Party(ies): Alexander's of Rego Park III

Note: For Parts 1. – 3. the individuals, groups, organizations, businesses, and units of government identified should be added to the site contact list as appropriate.

Part 1. List major issues of public concern and information the community wants. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and information needs. Use this information as an aid to prepare or update the Major Issues of Public Concern section of the site Citizen Participation Plan.

As of the date of preparation of this Citizen Participation Plan, no individuals, community groups, or related organizations have offered comments or demonstrated interest in this project.

The proposed investigation of soil, groundwater, and sub-surface soil vapor may have odor and air quality impacts. Air monitoring and site controls will be in place during investigation activities, in accordance with NYSDEC and NYSDOH regulations, to minimize impacts.

How were these issues and/or information needs identified? The site was the subject of a Phase I Environmental Site Assessment and four subsurface investigations between 1994 and 2021, during which past site use and site contamination were identified.

Part 2. List important information needed **from** the community, if applicable. Identify individuals, groups, organizations, businesses and/or units of government related to the information needed. No additional information is required from the community at this time.

How were these information needs identified? Not Applicable

Part 3. List major issues and information that need to be communicated **to** the community. Identify individuals, groups, organizations, businesses and/or units of government related to the issue(s) and/or information.

The community will continue to be made aware of the following issues and information:

- Contaminants of concern related to historic site use;
- Project contacts and ways to get information;
- Components of the selected remedy;
- Progress and major project milestones; and
- Investigation, remediation, and construction schedules

How were these issues and/or information needs identified?

These issues were identified by review of project information and experience on similar projects.

Part 4. Identify the following characteristics of the affected/interested community. This knowledge will help to identify and understand issues and information important to the community, and ways to effectively develop and implement the site citizen participation plan (mark all that apply):

a. Land use/zoning at and around site:
b. Residential type around site: ⊠ Urban □ Suburban □ Rural
 c. Population density around site: ☑ High □ Medium □ Low
 d. Water supply of nearby residences: Public
e. Is part or all of the water supply of the affected/interested community currently impacted by the site? □ Yes ⊠ No
Provide details if appropriate: Not Applicable
f. Other environmental issues significantly impacted/impacting the affected community? \Box Yes \boxtimes No
Provide details if appropriate: Not Applicable.
g. Is the site and/or the affected/interested community wholly or partly in an Environmental Justice Area? Yes D No
h. Special considerations:
Explain any marked categories in h: The site is located in an area that has a large Chinese-speaking and Indian population. Future fact sheets will be translated into Chinese and Hindi.
Part 5. The site contact list must include, at a minimum, the individuals, groups, and organizations identified in Part 2. of the Citizen Participation Plan under 'Site Contact List'. Are <i>other</i> individuals, groups, organizations, and units of government affected by, or interested in, the site, or its remedial program? (Mark and identify all that apply, then adjust the site contact list as appropriate.)
Non-Adjacent Residents/Property Owners: See Contact List.
☑ Local Officials: See Contact List
Media: See Contact List
Business/Commercial Interests: See Contact List

- □ Labor Group(s)/Employees: Click here to enter text.
- □ Indian Nation: Click here to enter text.
- Citizens/Community Group(s): See Contact List

- □ Environmental Justice Group(s): Click here to enter text.
- □ Environmental Group(s): Click here to enter text.
- ☑ Civic Group(s): See Contact List
- **Recreational Group(s):** Click here to enter text.
- **Other(s):** Click here to enter text.

Prepared/Updated By: Langan Engineering, Environmental,	Date: Jan 11, 2022
Surveying, Landscape Architecture and Geology, D.P.C.	

Reviewed Approved By: Thomas V. Panzone

Date: Jan 7, 2022

APPENDIX E Construction Health and Safety Plan

CONSTRUCTION HEALTH AND SAFETY PLAN

FOR

26 REGO PARK CENTER III 61-10 JUNCTION BOULEVARD AND 93-30 93RD STREET REGO PARK, QUEENS, NEW YORK Queens Borough Tax Map Block 2076, Lots 50 and 63, Block 2077, Lots 90 and 98, Demapped former 94th Place & Demapped section of 62nd Avenue

Prepared For

Alexander's of Rego Park III, Inc. c/o Vornado Realty Trust 888 Seventh Avenue, 44th Floor New York, New York 10019

Prepared By:

Langan Engineering, Environmental, Surveying Landscape Architecture and Geology, D.P.C. 21 Penn Plaza 360 West 31st Street, 8th Floor New York, New York 10001



May 2022 Langan Project No. 170683801

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* Items to be posted prominently on site, or made readily available to personnel.

1.0 INTRODUCTION

1.1 General

This CONSTRUCTION HEALTH AND SAFETY PLAN (CHASP) was developed to address disturbance of known and reasonably anticipated subsurface contaminants and comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), *Hazardous Waste Operations and Emergency Response* during anticipated site work for the property known as for Rego Park Center III ("the site") located at 61-10 Junction Boulevard and 93-30 93rd Avenue in the Rego Park neighborhood of Queens, New York. The Site is identified as identified as Block 2076, Lots 50 and 63; Block 2077, Lots 90 and 98; the demapped former 94th Place; and a demapped section of 62nd Avenue on the Queens Borough Tax Map.

This CHASP provides the minimum requirements for implementing site operations during future remedial measure activities. All contractors performing work on this site shall implement their own CHASP that, at a minimum, adheres to this CHASP. The contractor is responsible for their own health and safety and that of their subcontractors. Langan personnel will implement this CHASP while onsite.

The content of this CHASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the work plan.

1.2 Site Location and Background

The site is located at 61-10 Junction Boulevard and 93-30 93rd Avenue in the Rego Park neighborhood of Queens, New York and is currently identified as Block 2076, Lots 50 and 63; Block 2077, Lots 90 and 98; the demapped former 94th Place; and a demapped section of 62nd Avenue on the Queens Borough Tax Map. Merger of the proposed BCP site into a single lot with metes and bounds that correspond to the proposed site boundaries is pending. A site location map is provided as Figure 1. The site encompasses an area of about 141,570 square feet (about 3.25 acres) and is currently used as a private parking lot, with the exception of a portion of Lot 50 and the demapped portion of 62nd Avenue, which are used as a vehicle turning bay at the eastern terminus of 62nd Avenue. The site is bound by the Horace Harding Expressway to the north, Junction Boulevard followed by a mixed-use residential and commercial use building to the east, 62nd Avenue and the Lost Battalion Hall Playground to the south, and 93rd Street followed by mixed-use residential and commercial buildings and parking lots to the west. In addition to commercial truck staging and maintenance, which ceased in the early 2000s, the site was historically used for vehicle repair (1995) and a gasoline filling station (1950). A site location

map is provided a Figure 1.

According to the New York City Planning Commission Zoning Map 14a, the site is located within a residential district (R8) with a commercial overlay (C2-2). The surrounding area is primarily commercial and industrial, but also includes residential buildings, public parks, day care centers, and schools.

1.3 Summary of Work Tasks

1.3.1 Excavation and Soil Screening

Langan personnel will screen excavated material for visual, olfactory, and instrumental indicators suggestive of a potential chemical or petroleum release. Instrument screening for the presence of volatile organic compounds (VOCs) may be performed with a duly calibrated Photoionization detector (PID). Contractors will excavate for utilities, foundation components and potential grading using heavy equipment and hand tools. Contractors will notify Langan personnel if they identify indications suggestive of a potential chemical or petroleum release. Contaminated material shall be handled and property disposed in accordance with federal, state and city regulations, criteria and guidelines.

1.3.2 Soil Screening

As part of future excavation activities, the Langan personnel will report when they have observed visual and olfactory indications of possible soil impact. Langan personnel will also report concentrations of VOCs above background when using a properly calibrated hand held PID, or equivalent.

1.3.3 Soil Sampling

Soil samples (waste characterization, excavation endpoint, delineation, or quality assurance/quality control [QA/QC]) may be collected during construction, as required. Langan personnel will coordinate with the contractor in sampling soil (in accordance with the SMP, where applicable). If stockpile soil sampling is required from above ground level, suitable excavation equipment (i.e., excavator, front end loader) should be used to collect the sample.

Soil samples excavation endpoint or delineation sampling (along with QA/QC samples) may be collected and subsequently submitted to a New York State Department of Health (NYSDOH) Environmental Laboratory Approval Program (ELAP)-certified laboratory and analyzed in accordance with work plan specifications.

1.3.4 Stockpiling

As part of future excavation activities, potentially impacted soil may be stockpiled pending laboratory analysis and determining proper off-site disposal. Visibly contaminated soil, if encountered, shall be segregated and stockpiled on at least 10 millimeters of plastic sheeting; reusable soil and fill shall be segregated and stockpiled separately from unusable fill, concrete and other debris; the stockpiles shall be kept covered with 6 millimeters thick plastic sheeting; the plastic sheeting covering the stockpiles shall be anchored firmly in place by weights, stakes, or both; the Contractor shall maintain the plastic sheeting.

1.3.5 Characterization of Excavated Material

When required by the work plan, Langan personnel will characterize excavated soil or clean backfill in accordance with Langan standards.

1.3.6 Excavation Backfill

Areas of the site that were over-excavated may be backfilled to development grade (i.e., the grade required to complete construction of the foundation and sidewalk extension). Imported material will consist of clean fill that meets the 6 New York Codes, Rules and Regulations (NYCRR) Part 375-6.8(a) Unrestricted Use Soil Cleanup Objectives (UU SCOs) or other acceptable fill material such as virgin stone from a permitted mine or quarry or recycled concrete aggregate (RCA), from a New York State Department of Environmental Conservation (NYSDEC)-registered facility in compliance with 6 NYCRR Part 360 registration and permitting requirements for the period of RCA acquisition. Imported RCA must be derived from recognizable and uncontaminated concrete. RCA is not acceptable for, and will not be used as, site cover or drainage material.

1.3.7 Decommissioning and Removal of Underground Storage Tank

If an underground storage tank (UST) is encountered, a UST decommissioning and removal contractor shall furnish all labor and materials, equipment and incidentals required for the proper decontamination, removal and closure of any UST in accordance with federal, state and local regulations. Langan personnel will monitor VOCs with a calibrated PID downwind from the UST excavation and record the PID readings.

1.3.8 Construction Dewatering

Construction dewatering may be required, the dewatering contractor shall be responsible for

handling contaminated dewatering fluids in accordance with federal, state and local regulations. Dewatering fluids are likely to be discharged to the local sanitary sewer system after treatment and under approved regulatory permit. Alternatively, the contractor may provide containerized storage to allow for testing of groundwater prior to, and after, treatment and before disposal. If required, Langan field personnel may sample dewatering treatment system liquids from either a discharge standpipe or a storage tank. Dewatering samples will be submitted to an ELAP-certified laboratory for analysis.

1.3.9 Observation/Monitoring Well Plugging and Abandonment

At an unspecified future date, site observation/monitoring wells may be abandoned. Plugging and abandonment will be in accordance with federal and state requirements. Langan may retain a drilling contractor to complete the plugging and abandonment activities. The contractor will contact the appropriate utility mark-out authority and make available to their field staff the verification number and effective dates. Langan may observe the plugging and abandonment of one or more observation/monitoring wells to document that the plugging and abandonment activities were completed in accordance with the work plan and regulations.

1.3.10 Soldier Pile and Lagging Installation

Langan will observe the contractor installation of soldier piles and lagging. These activities are to be done in accordance with the work plan. These activities are to be performed by the contractor in accordance with the construction documents and they will complete these tasks following their own CHASP. Materials used for construction may be inspected by Langan for conformance to the design documents.

1.3.11 Installation of Tiebacks

Langan will observe the contractor installation of tiebacks for the soldier pile and lagging wall as well as the tieback testing. These activities are to be done in accordance with the work plan. The work will be performed by the contractor in accordance with the construction documents and they will complete these tasks following their own CHASP.

1.3.12 Construction Activity Inspections and Observations

Langan will observe construction activities including remedial construction performed by the contractor in accordance with the construction documents, RAWP, and requirements administered by the New York City Department of Buildings. Materials used for construction will be inspected by Langan for conformance to the design documents.

1.3.13 Storm water Pollution Prevention Inspection

In accordance with the work plan, Langan personnel with Storm Water Pollution Prevention (SWPPP) inspection credentials will conduct SWPPP inspections.

1.3.14 Equipment Decontamination

Before the start of the day's sampling and after sampling each run, sampling equipment will be decontaminated by the decontamination process outlined Attachment B - Decontamination Procedures. Decontamination wastes and purge water will be temporarily stored on site pending analytical results.

1.3.15 Management of Investigative-Derived Waste

The investigative-derived waste (IDW) generated during this investigation may stockpiled as defined in this CHASP or contained in DOT-approved 55-gallon drums. The drums will be temporarily stored on the site or as directed by the client representative. All drums will be filled between to two-thirds full to allow easy maneuvering during drum pickup and disposal. Drum labels are to be provided by Langan (Environmental Closet). All drums will be labeled as "IDW Pending Analysis" until sample data are reported from the laboratory. Drum labels will include date filled and locations where waste was generated along with the standard information required by the labels in accordance with the Langan SOP09, Drum Labeling..

Closed top drums are to be used to store liquids. Debris, including plastic sheeting, polyethylene tubing, personal protection equipment (PPE), decontamination debris, etc. will be segregated from and disposed in large heavy duty garbage bags and disposed of at the site. Excess unused glassware should be returned to the lab along with the last day of collection samples.

1.3.16 Drum Sampling

Excess or impacted soil and water that is drummed during the remedial action activities must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan personnel will collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

1.3.17 Surveying

If specified in the work plan, surveying activities may be completed by Langan. Surveying will be conducted by licensed surveyors.

2.0 IDENTIFICATION OF KEY PERSONNEL/HEALTH AND SAFETY PERSONNEL

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this site. The titles have been established to accommodate the project needs and requirements and ensure the safe conduct of site activities. The H&S personnel requirements for a given work location are based upon the proposed site activities.

2.1 Langan Project Manager

The Langan Environmental Project Manager (PM) is Stuart Knoop, the Geotechnical PM is James Delimitros and the Site/Civil PM is Kelly Tuffs, their responsibilities include:

- Ensuring that this CHASP is developed, current, and approved prior to on-site activities.
- Ensuring that all the tasks in the project are performed in a manner consistent with Langan's comprehensive *Health and Safety Program for Hazardous Waste Operations* and this CHASP.

2.2 Langan Corporate Health and Safety Manager

The Langan Corporate Health and Safety Manager is Tony Moffa. His responsibilities include:

- Updating the Construction Health and Safety Program for Hazardous Waste Operations.
- Assisting the site Health and Safety Officer (HSO) with development of the CHASP, updating CHASP as dictated by changing conditions, jobsite inspection results, etc. and approving changes to this CHASP.
- Assisting the HSO in the implementation of this CHASP and conducting Jobsite Safety Inspections and assisting with communication of results and correction of shortcomings found.
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

2.3 Langan Site Health & Safety Officer

The Langan site HSO is William Bohrer. His responsibilities include:

- Participating in the development and implementation of this CHASP.
- When on-site, assisting the Langan Field Team Leader in conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely

manner.

- Ensuring that proper PPE is available, worn by employees, and properly stored and maintained.
- Controlling entry into and exit from the site contaminated areas or zones.
- Monitoring employees for signs of stress, such as heat stress, fatigue, and cold exposure.
- Monitoring site hazards and conditions.
- Knowing (and ensuring that all site personnel also know) emergency procedures, evacuation routes, and the telephone numbers of the ambulance, local hospital, poison control center, fire department, and police department.
- Resolving conflicts that may arise concerning safety requirements and working conditions.
- Reporting all incidents, injuries and near misses to the Langan Incident/Injury Hotline immediately and the client representative.

2.4 Langan Field Team Leader Responsibilities

The Langan Field Team Leader (FTL) is to be determined prior to the start of the start of field activities. The Field Team Leader's responsibilities include:

- The management of the day-to-day site activities and implementation of this CHASP in the field.
- Participating in and/or conducting Tailgate Safety Meetings and Jobsite Safety Inspections and correcting any shortcomings in a timely manner.
- When a Community Air Monitoring Operating Program (CAMP) is part of the scope, the FTL will set up and maintaining community air monitoring activities and instructing the responsible contractor to implement organic vapor or dust mitigation when necessary.
- Overseeing the implementation of activities specified in the work plan.

2.5 Contractor Responsibilities

The contractor shall develop and implement their own CHASP for their employees, lower-tier subcontractors, and consultants. The contractor is responsible for their own health and safety and that of their subcontractors. Contractors operating on the site shall designate their own FTL, HSO and HSM. The contractor's CHASP will be at least as stringent as this Langan CHASP. The contractor must be familiar with and abide by the requirements outlined in their own CHASP. A contractor may elect to adopt Langan's CHASP as its own provided that it has given written notification to Langan, but where Langan's CHASP excludes provisions pertinent to the contractor's work (i.e., confined space entry); the contractor must provide written addendums to

this CHASP. Additionally, the contractor must:

- Ensure their employees are trained in the use of all appropriate personal protection equipment (PPE) for the tasks involved;
- Notify Langan of any hazardous material brought onto the job site or site related area, the hazards associated with the material, and must provide a material safety data sheet (MSDS) or safety data sheet (SDS) for the material;
- Have knowledge of, understand, and abide by all current federal, state, and local health and safety regulations pertinent to the work;
- Ensure their employees handling hazardous materials, if identified at the Site, have received current training in the appropriate levels of 29 CFR 1910.120, *Hazardous Waste Operations and Emergency Response* (HAZWOPER) if hazardous waste is identified at the Site;
- Ensure their employees handling hazardous materials, if identified at the Site, have been fit-tested within the year on the type respirator they will wear; and
- Ensure all air monitoring is in place pertaining to the health and safety of their employees as required by OSHA 1910.120; and
- All contractors must adherer to all federal, state, and local regulatory requirements.

3.0 TASK/OPERATION SAFETY AND HEALTH RISK ANALYSES

A Task-Hazard Analysis (Table 1) was completed for general construction hazards that may be encountered at the Site. The potential contaminants that might be encountered during the field activities and the exposure limits are listed in Table 2 complete inventory of MSDS/SDS for chemical products used on site is included as Attachment E.

3.1 Specific Task Safety Analysis

3.1.1 Excavation and Soil Screening

Langan personnel will observe excavation and SOE activities including the general oversight, observation of landscaping activities, and other select observation project management and supervision as specified in the work plan or in accordance with the construction documents, or special inspection requirements administered by the New York City Department of Buildings. Materials used for construction may be inspected by Langan personnel for conformance to the design documents. Prior to entering excavation, Langan personnel will insure that excavation shoring conforms to proper shoring/benching/sloping techniques, at a minimum that soil and equipment is kept at least 2 feet from the edge of the excavation, that there is no water in the excavation, and that a competent person has inspected excavation prior to allow persons to enter.

When entering excavation via a ladder, Langan personnel will only use ladders that are properly situated in accordance with the Ladder section of the CHASP.

3.1.2 Soil Screening and Sampling

Sampling the soil requires the donning of chemical resistant gloves in addition to the standard PPE. Langan personnel are not to operate drilling or excavation equipment nor open sampling devices (acetate liners, sonic sample bags, etc.). These tasks are to be completed by the driller or excavation contractor.

3.1.3 Stockpile Sampling

The Langan personnel are not to scale or climb stockpiles. If the soil sampling plan requires sampling from the stockpile above ground level, samples are to be obtained using suitable excavation equipment operated by the contractor (i.e. front end loader).3.1.3 Indoor Drilling and Excavation

3.1.4 Indoor Drilling and Excavation

The work scope may require indoor work or work in locations where there may not be adequate ventilation sufficient to safely operate any rig or excavation equipment powered by an internal combustion engine. Where possible, all such work should be done by equipment powered by electricity. If such equipment is used and must be directly wired to the buildings electrical system or to an independent system, this work must be completed by a licensed electrician in accordance with all electrical codes applicable to the work.

Indoor work which is to be completed with equipment powered by an internal combustion engine must incorporate air monitoring of carbon monoxide (CO) using calibrated air monitoring equipment (MultiRAE or equivalent). In addition, the work plan should incorporate mitigation for venting engine exhaust fumes directly to the outdoors and for circulating fresh air into the work area.

The OSHA Time Weighted Average (TWA) Permissible Exposure Limit (PEL) for CO from 50 to 35 parts per million (ppm). Langan will monitor CO with a suitable monitoring device. If CO levels exceed 5 ppm, Langan will instruct contractors to begin mitigation measures. These measures are at a minimum:

• Increase air circulation using industrial size fans to bring additional fresh air into the building or vent exhaust to the outside;

- Modify the passive exhaust method being used to increase venting circulation by using wider diameter tubing or sealing tubing connections; or
- Modify the work schedule where the rig is turned off to allow time for CO levels to fall back to background

All work must cease if CO levels reach 35 ppm. The Langan engineer is to report to the PM and H&S officer when an action level is reached.

3.1.5 Construction Dewatering

If required, Langan may sample dewatering treatment system liquids from either the direct discharge standpipe or from a sample port or valve built into the storage tank, Langan will don the necessary PPE including nitrile gloves and if necessary, facial splash guard. Sample ports and valves may only be sampled if they are accessible at ground level. Sampling from heights over 6 feet is prohibited unless Langan field personnel are fully accredited in fall protection and is wearing approved fall protection safety apparatus. The discharge samples will be submitted to an ELAP-certified laboratory for analysis in accordance with the work plan.

3.1.6 Removal of Underground Storage Tank

If UST excavation and removal activity is initiated, Langan personnel will conduct air monitoring for lower explosion limit (LEL) conditions within the UST excavation itself. This task is to be performed using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation. Langan personnel are not to enter the UST excavation nor enter an excavated UST.

In addition to monitoring LEL, Langan personnel will monitor atmospheric VOC concentrations directly downwind of the UST excavation in accordance with standard CAMP procedures using calibrated air monitoring equipment.

3.1.7 Storm water Pollution Prevention Inspection

When performing SWPPP inspections, Langan personnel will don all required PPE and maintain awareness to site traffic and site activities. If using a cell phone or tablet application to record

the pertinent data, the engineer will do so in an area protected from site traffic and activities. Certain types of inspections may require additional PPE and safety training including fall protection.

3.1.8 Backfilling of Excavated Areas to Development Grade

The backfilling contractor will provide their employees with equivalent PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards. Langan personnel may survey backfilling material with a calibrated PID; however, as they are not permitted to climb the material delivery truck, the contractor must provide samples from each truck as required.

3.1.9 Construction Activity Inspection

Langan personnel will inspect the remedial work in accordance with specification in the work plan and record the data the work plan requires. Remedial contractors will following their own health and safety specifications outlined in their CHASPs. Other activities assigned to Langan as part of construction activities are limited to inspection and observations as specified in the work plan. Langan personnel are not to operate or assist in the operation of equipment used in construction activities unless defined as part of an inspection or observation in the work plan.

3.1.10 Pile Installation

Observing and inspecting pile installation must be done from a safe distance and Langan personnel should avoid or otherwise limit their presence within the swing radius of the crane to avoid injury. Persons working near the crane must remain alert and aware of the crane's movements and stay away from the path of travel of the crane boom. No persons shall be allowed directly under the leads of the crane.

3.1.11 Plugging and Abandonment of Observation/Monitoring Wells

Langan personnel are not to operate equipment nor assist in the plugging and abandonment of the observation/monitoring wells. These tasks are to be completed by the contractor.

3.1.12 Drum Sampling

Drilling fluid, rinse water, grossly-contaminated soils samples and cuttings may be containerized

in 55-gallon drums for transport and disposal off site. Each drum must be labeled in accordance with the Langan Drum Labeling Standard Operating Procedure (SOP-#9). Langan may collect drum samples, as required, prior to off-site drum disposal. Samples will be placed into laboratory-supplied batch-certified clean glassware and submitted to a NYSDOH ELAP-certified laboratory.

Langan employees and contractors are not to move or open any orphaned (unlabeled) drum found on the site without approval of the project manager.

3.2 Radiation Hazards

No radiation hazards are known or expected at the site.

3.3 Physical Hazards

Physical hazards, which may be encountered during site operations for this project, are detailed in Table 1.

3.3.1 Explosion

No explosion hazards are expected for the scope of work at this site.

3.3.2 Heat Stress

The use of Level C protective equipment, or greater, may create heat stress. Monitoring of personnel wearing personal protective clothing should commence when the ambient temperature is 72°F or above. Table 6 presents the suggested frequency for such monitoring. Monitoring frequency should increase as ambient temperature increases or as slow recovery rates are observed. Refer to the Table 7 to assist in assessing when the risk for heat related illness is likely. To use this table, the ambient temperature and relative humidity must be obtained (a regional weather report should suffice). Heat stress monitoring should be performed by the HSO or the FTL, who shall be able to recognize symptoms related to heat stress.

To monitor the workers, be familiar with the following heat-related disorders and their symptoms:

- Heat Cramps: Painful spasm of arm, leg or abdominal muscles, during or after work
- **Heat Exhaustion:** Headache, nausea, dizziness; cool, clammy, moist skin; heavy sweating; weak, fast pulse; shallow respiration, normal temperature
- **Heat Stroke**: Headache, nausea, weakness, hot dry skin, fever, rapid strong pulse, rapid deep respirations, loss of consciousness, convulsions, coma. <u>This is a life threatening</u>

<u>condition</u>.

<u>Do not</u> permit a worker to wear a semi-permeable or impermeable garment when they are showing signs or symptoms of heat-related illness.

To monitor the worker, measure:

- Heart rate: Count the radial pulse during a 30-second period as early as possible in the rest period. If the heart rate exceeds 100 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same. If the heart rate still exceeds 100 beats per minute at the next rest period, shorten the following work cycle by one-third. A worker cannot return to work after a rest period until their heart rate is below 100 beats per minute.
- Oral temperature: Use a clinical thermometer (3 minutes under the tongue) or similar device to measure the oral temperature at the end of the work period (before drinking). If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period. A worker cannot return to work after a rest period until their oral temperature is below 99.6°F. If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following cycle by one-third. Do not permit a worker to wear a semi-permeable or impermeable garment when oral temperature exceeds 100.6°F (38.1°C).

<u>Prevention of Heat Stress</u> - Proper training and preventative measures will aid in averting loss of worker productivity and serious illness. Heat stress prevention is particularly important because once a person suffers from heat stroke or heat exhaustion, that person may be predisposed to additional heat related illness. To avoid heat stress the following steps should be taken:

- Adjust work schedules.
- Mandate work slowdowns as needed.
- Perform work during cooler hours of the day if possible or at night if adequate lighting can be provided.
- Provide shelter (air-conditioned, if possible) or shaded areas to protect personnel during rest periods.
- Maintain worker's body fluids at normal levels. This is necessary to ensure that the cardiovascular system functions adequately. Daily fluid intake must approximately equal the amount of water lost in sweat, id., eight fluid ounces (0.23 liters) of water must be ingested for approximately every eight ounces (0.23 kg) of weight lost. The normal thirst mechanism is not sensitive enough to ensure that enough water will be drunk to replace

lost sweat. When heavy sweating occurs, encourage the worker to drink more. The following strategies may be useful:

- Maintain water temperature 50° to 60°F (10° to 16.6°C).
- Provide small disposal cups that hold about four ounces (0.1 liter).
- Have workers drink 16 ounces (0.5 liters) of fluid (preferably water or dilute drinks) before beginning work.
- Urge workers to drink a cup or two every 15 to 20 minutes, or at each monitoring break. A total of 1 to 1.6 gallons (4 to 6 liters) of fluid per day are recommended, but more may be necessary to maintain body weight.
- Train workers to recognize the symptoms of heat related illness.

3.3.3 Cold-Related Illness

If work on this project begins in the winter months, thermal injury due to cold exposure can become a problem for field personnel. Systemic cold exposure is referred to as hypothermia. Local cold exposure is generally called frostbite.

- **Hypothermia** Hypothermia is defined as a decrease in the patient core temperature below 96°F. The body temperature is normally maintained by a combination of central (brain and spinal cord) and peripheral (skin and muscle) activity. Interference with any of these mechanisms can result in hypothermia, even in the absence of what normally is considered a "cold" ambient temperature. Symptoms of hypothermia include: shivering, apathy, listlessness, sleepiness, and unconsciousness.
- Frostbite Frostbite is both a general and medical term given to areas of local cold injury. Unlike systemic hypothermia, frostbite rarely occurs unless the ambient temperatures are less than freezing and usually less than 20°F. Symptoms of frostbite are: a sudden blanching or whitening of the skin; the skin has a waxy or white appearance and is firm to the touch; tissues are cold, pale, and solid.

Prevention of Cold-Related Illness - To prevent cold-related illness:

- Educate workers to recognize the symptoms of frostbite and hypothermia
- Identify and limit known risk factors:
- Assure the availability of enclosed, heated environment on or adjacent to the site.
- Assure the availability of dry changes of clothing.
- Assure the availability of warm drinks.
- Start (oral) temperature recording at the job site:
- At the FSO or Field Team Leader's discretion when suspicion is based on changes in a worker's performance or mental status.

- At a worker's request.
- As a screening measure, two times per shift, under unusually hazardous conditions (e.g., wind-chill less than 20°F, or wind-chill less than 30°F with precipitation).
- As a screening measure whenever anyone worker on the site develops hypothermia.

Any person developing moderate hypothermia (a core temperature of 92°F) cannot return to work for 48 hours.

3.3.4 Noise

Work activities during the proposed activities may be conducted at locations with high noise levels from the operation of equipment. Hearing protection will be used as necessary.

3.3.5 Hand and Power Tools

The use of hand and power tools can present a variety of hazards, including physical harm from being struck by flying objects, being cut or struck by the tool, fire, and electrocution. All hand and power tools should be inspected for health and safety hazards prior to use. If deemed unserviceable/un-operable, notify supervisor and tag equipment out of service. Ground Fault Circuit Interrupters (GFCIs) are required for all power tools requiring direct electrical service.

3.3.6 Slips, Trips and Fall Hazards

Care should be exercised when walking at the site, especially when carrying equipment. The presence of surface debris, uneven surfaces, pits, facility equipment, and soil piles contribute to tripping hazards and fall hazards. To the extent possible, all hazards should be identified and marked on the site, with hazards communicated to all workers in the area.

3.3.7 Utilities (Electrocution and Fire Hazards)

3.3.7.1 Utility Clearance

The possibility of encountering underground utilities poses fire, explosion, and electrocution hazards. All excavation work will be preceded by review of available utility drawings and by notification of the subsurface work to the N.Y. One –Call–Center.

3.3.7.2 Lockout-Tagout

The potential adverse effects of electrical hazards include burns and electrocution, which could

result in death. Therefore, there is a procedure that establishes the requirements for the lockout/tagout (LOTO) of energy isolating devices in accordance with the OSHA electrical lockout and tagging requirements as specified in 29 CFR 1926.417. This procedure will be used to ensure that all machines and equipment are isolated from potentially hazardous energy. If possible, equipment that could cause injury due to unexpected energizing, start-up, or release of stored energy will be locked/tagged, before field personnel perform work activities.

Depending upon the specific work task involved, Langan's SSC or FTL will serve as the authorized lockout/tagout coordinator, implement the lockout/tagout procedure and will be responsible to locate, lock and tag valves, switches, etc.

SPECIAL NOTE: Project personnel will assume that all electrical equipment at surface, subsurface and overhead locations is energized, until equipment has been designated and confirmed as de-energized by a utility company representative. Langan will notify the designated utility representative prior to working adjacent to this equipment and will verify that the equipment is energized or de-energized in the vicinity of the work location.

No project work shall be performed by Langan personnel or subcontractors on or near energized electrical lines or equipment unless hazard assessments are completed in writing, reviewed by Langan's SSHO, and clearly communicated to the field personnel.

The FTL shall conduct a survey to locate and identify all energy isolating devices. They shall be certain which switches, valves or other isolating devices apply to the equipment. The lockout/tagout procedure involves, but is not limited to, electricity, motors, steam, natural gas, compressed air, hydraulic systems, digesters, sewers, etc.

3.3.8 Physical Hazard Considerations for Material Handling

There are moderate to severe risks associated with moving heavy objects at the Site. The following physical hazards should be considered when handling materials at the Site:

- Heavy objects will be lifted and moved by mechanical devices rather than manual effort whenever possible.
- The mechanical devices will be appropriate for the lifting of moving task and will be operated only by trained and authorized personnel.
- Objects that require special handling or rigging will only be moved under the guidance of a person who has been specifically trained to move such objects.

- Lifting devices will be inspected, certified, and labeled to confirm their weight capacities. Defective equipment will be taken out of service immediately and repaired or destroyed.
- The wheels of any trucks being loaded or unloaded will be chocked to prevent movement. Outriggers will be fully extended on a flat, firm surface during operation.
- Personnel will not pass under a raised load, nor will a suspended load be left unattended.
- Personnel will not be carried on lifting equipment, unless it is specifically designed to carry passengers.
- All reciprocating, rotating, or other moving parts will be guarded at all times.
- Accessible fire extinguishers, currently (monthly) inspected, will be available in all mechanical lifting devices.
- Verify all loads/materials are secure before transportation.

Material handling tasks that are unusual or require specific guidance will need a written addendum to this CHASP. The addendum must identify the lifting protocols before the tasks are performed. Upon approval, the plan must be reviewed with all affected employees and documented. Any deviation from a written plan will require approval by the Langan HSM.

3.3.9 Hearing Conservation

Under the construction industry standard, the maximum permissible occupational noise exposure is 90 dbA (8-hour TWA), and noise levels in excess of 90 dbA must be reduced through feasible administrative and engineering controls. (20 CFR 1926.52). Hearing protection is required when working within 15 feet of vacuum extraction equipment and drill rigs.

3.3.9 Open Water

Employees working over or near water, where the danger of drowning exists, shall be provided with U.S. Coast Guard-approved life jackets or buoyant work vests. Prior to and after each use, the buoyant work vests or life preservers shall be inspected for defects which would alter their strength or buoyancy. Defective units shall not be used.

And should a worker fall into the water, OSHA requires (29 CFR 1926.106(c)) that ring buoys with at least 90 feet of line shall be provided and readily available for emergency rescue operations. The distance between ring buoys shall not exceed 200 feet. Another remedial action required by OSHA (29 CFR 1926.106(d)) is the use of lifesaving skiffs.

OSHA requires that at least one lifesaving skiff shall be immediately available at locations where

employees are working over or adjacent to water and must include the following provisions.

- The skiff must be in the water or capable of being quickly launched by one person.
- At least one person must be present and specifically designated to respond to water emergencies and operate the skiff at all times when there are employees above water.
- When the operator is on break another operator must be designated to provide requisite coverage when there are employees above water.
- The designated operator must either have the skiff staffed at all times or have someone remain in the immediate area such that the operator can quickly reach the skiff and perform rescue services.
- The skiff operator maybe assigned other tasks provided the tasks do not interfere with the operator's ability to quickly reach the skiff.
- A communication system, such as a walkie-talkie, must be used to inform the skiff operator of an emergency and to inform the skiff operator where the skiff is needed.
- The skiff must be equipped with both a motor and oars.

With regard to the number of skiffs required and the appropriate maximum response time, the following factors must be evaluated:

- The number of work locations where there is a danger of falling into water;
- The distance to each of those locations;
- Water temperature and currents;
- Other hazards such as, but not limited to, rapids, dams, and water intakes;

Other regulations that present S&H practices and PPE for work on or near water include: 29 CFR 1910, Subpart T (401 – 440)

3.4 Biological Hazards

3.4.1 Animals

There is a possibility of encountering wildlife including reptiles, rodents and other small and medium size mammals. The Langan personnel is to avoid interacting with any wildlife.

3.4.2 Insects

Ticks and other biting or stinging insects may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and insecticide to prevent bites and stings. After field work, Langan personnel should perform a complete visual inspection of their clothing to insure they are not inadvertently harboring ticks. If they do observe a tick bite, they are to contact the HSM or HSO and report the event.

3.4.3 Plants

Poisonous plants may to be encountered during site operations. Langan personnel should take necessary precautions including donning long sleeve shirts and applying preventative poison lvy/Sumac lotion to prevent or limit effects of exposure. If after field work, Langan employees do observe a reaction to poisonous plant exposure, they are to contact the HSM or HSO and report the event.

3.5 Additional Safety Analysis

3.5.1 Presence of Non-Aqueous Phase Liquids (NAPL)

There is potential for exposure to NAPL at this site. Special care and PPE should be considered when NAPL is observed as NAPL is a typically flammable fluid and releases VOCs known to be toxic and/or carcinogenic. If NAPL is present in a monitoring well, vapors from the well casing may contaminate the work area breathing zone with concentrations of VOCs potentially exceeding health and safety action levels. In addition, all equipment used to monitor or sample NAPL (or ground water from wells containing NAPL) must be intrinsically safe. Equipment that directly contacts NAPL must also be resistant to organic solvents.

At a minimum, a PID should be used to monitor for VOCs when NAPL is observed. If NAPL is expected to be observed in an excavation or enclosed area, air monitoring must be started using calibrated air monitoring equipment designed to sound an audio alarm when atmospheric concentrations of VOC are within 10% of the LEL. In normal atmospheric oxygen concentrations, the LEL monitoring may be done with a Wheatstone bridge/catalytic bead type sensor (i.e. MultiRAE). However in oxygen depleted atmospheres (confined space), only an LEL designed to work in low oxygen environments may be used. Best practices require that the LEL monitoring unit be equipped with a long sniffer tube to allow the LEL unit to remain outside the UST excavation.

When NAPL is present, Langan personnel are required to use disposable nitrile gloves at all times to prevent skin contact with contaminated materials. They should also consider having available a respirator and protective clothing (Tyvek® overalls), especially if NAPL is in abundance and there are high concentrations of VOCs.

All contaminated disposables including PPE and sampling equipment must be properly disposed of in labeled 55-gallon drums

3.6 Job Safety Analysis

A Job Safety Analysis (JSA) is a process to identify existing and potential hazards associated with each job or task so these hazards can be eliminated, controlled or minimized. A JSA will be performed at the beginning of each work day, and additionally whenever an employee begins a new task or moves to a new location. All JSAs must be developed and reviewed by all parties involved. A blank JSA form and documentation of completed JSAs are in Attachment G.

4.0 PERSONNEL TRAINING

4.1 Basic Training

Completion of an initial 40-hour HAZWOPER training program as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees working on a site engaged in hazardous substance removal or other activities which expose or potentially expose workers to hazardous substances, health hazards, or safety hazards as defined by 29 CFR 1910.120(a). Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, all employees must complete the OSHA 10 hour Construction Safety and Health training and supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

4.2 Initial Site-Specific Training

Training will be provided to specifically address the activities, procedures, monitoring, and equipment for site operations at the beginning of each field mobilization and the beginning of each discrete phase of work. The training will include the site and facility layout, hazards, and emergency services at the site, and will detail all the provisions contained within this CHASP. For a HAZWOPER operation, training on the site must be for a minimum of 3 days. Specific issues that will be addressed include the hazards described in Section 3.0.

4.3 Tailgate Safety Briefings

Before starting work each day or as needed, the Langan HSO will conduct a brief tailgate safety meeting to assist site personnel in conducting their activities safely. Tailgate meetings will be documented in Attachment H. Briefings will include the following:

- Work plan for the day;
- Review of safety information relevant to planned tasks and environmental conditions;
- New activities/task being conducted;

- Results of Jobsite Safety Inspection Checklist;
- Changes in work practices;
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

5.0 MEDICAL SURVEILLANCE

All personnel who will be performing field work involving potential exposure to toxic and hazardous substances (defined by 29 CFR 1910.120(a)) will be required to have passed an initial baseline medical examination, with follow-up medical exams thereafter, consistent with 29 CFR 1910.120(f). Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine.

Additionally, personnel who may be required to perform work while wearing a respirator must receive medical clearance as required under CFR 1910.134(e), *Respiratory Protection*. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Results of medical evaluations are maintained by the HSM.

5.1 Mercury Monitoring

Langan includes medical monitoring for mercury during the initial baseline and annual physical.

5.2 Coronavirus

General Preventative Measures

Field personnel must follow general proper hygiene measures while in the field including:

- Avoid touching eyes, nose and mouth.
- Cover cough or sneeze with tissue, and throw in trash.
- Wash hands often with soap and water for 20 seconds after going to bathroom, before eating, after blowing nose, coughing or sneezing.
- Use hand sanitizer with at least 60% alcohol if soap and water are not available.
- Avoid physical contact with other people (e.g., no handshakes).
- Maintain a safe distance of at least 6 feet from other people (social distancing).
- Wear face coverings when around other worker to minimize spread of COVID-19. (May

be required in certain states or locations.)

Construction Trailers

Employees should avoid use of shared construction trailers or where employees cannot maintain a safe distance (minimum 6 feet) from other workers. If trailer use is needed, areas such as desks, phones, chairs and other common areas, should be cleaned and disinfected before and after use. Protocols should be developed to minimize trailer use to essential personal, restrict use from any workers who are ill or showing symptoms of being ill, use if face coverings and ensure a safe distance of 6 feet can be established between workers.

Communication

Include Coronavirus topics and prevention topics in daily tailgate meetings to ensure Coronavirus awareness is communicated daily. Discussions can focus on general topics including: social distancing, prevention measures for field personnel, signs and symptoms and recent news on the Coronavirus. Site-specific topics should include minimizing face-to-face contact, disinfecting/sterilizing field equipment, use of PPE to reduce exposure, site security, use of face coverings and other potential exposure issues/concerns.

Sick/III Workers

No Langan employee is permitted to be onsite when ill and/or showing potential symptoms of the Coronavirus. Symptoms of the Coronavirus may appear 2-14 days after exposure and can range from mild to severe. The most common symptoms include: fever, fatigue, dry cough, shortness of breath chills, repeated shaking with chills, muscle pain, headache, sore throat, or new loss of taste or smell. If an employee or subcontractor is observed being ill or exhibiting symptoms of Coronavirus, employees must immediately utilize their Stop Work Authority and contact their project manager to address the situation. If an employee observes another worker onsite exhibiting symptoms of Coronavirus, immediately utilize Stop Work Authority and notify their project manager and site construction manager or safety officer. Work should resume when the safety and health of Langan and subcontractors is adequately addressed.

6.0 PERSONAL PROTECTIVE EQUIPMENT

6.1 Levels of Protection

Langan will provide PPE to Langan employees to protect them from the specific hazards they are likely to encounter on-site. Direct hired contractors will provide their employees with equivalent

PPE to protect them from the specific hazards likely to be encountered on-site. Selection of the appropriate PPE must take into consideration: (1) identification of the hazards or suspected hazards; (2) potential exposure routes; and, (3) the performance of the PPE construction (materials and seams) in providing a barrier to these hazards.

Based on anticipated site conditions and the proposed work activities to be performed at the site, Level D protection will be used. The upgrading/downgrading of the level of protection will be based on continuous air monitoring results as described in Section 6.0 (when applicable). The decision to modify standard PPE will be made by the site HSO or FTL after conferring with the PM. The levels of protection are described below.

Level D Protection (as needed)

- Safety glasses with side shields or chemical splash goggles
- Safety boots/shoes
- Coveralls (Tyvek[®] or equivalent)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection
- Reflective safety vest

Level D Protection (Modified, as needed)

- Safety glasses with sideshields or chemical splash goggles
- Safety boots/shoes (toe-protected)
- Disposable chemical-resistant boot covers
- Coveralls (polycoated Tyvek or equivalent to be worn when contact with wet contaminated soil, groundwater, or non-aqueous phase liquids is anticipated)
- Hard hat
- Long sleeve work shirt and work pants
- Nitrile gloves
- Hearing protection (as needed)
- Personal floatation device (for work within 5 ft of the water)
- Reflective traffic vest

Level C Protection (as needed)

- Full or Half face, air-purifying respirator, with NIOSH approved HEPA filter
- Inner (latex) and outer (nitrile) chemical-resistant gloves
- Safety glasses with side shields or chemical splash goggles
- Chemical-resistant safety boots/shoes
- Hard hat
- Long sleeve work shirt and work pants
- Coveralls (Tyvek[®] or equivalent)
- Hearing protection (as needed)
- Reflective safety vest

The action levels used in determining the necessary levels of respiratory protection and upgrading to Level C are summarized in Table 4. The written Respiratory Protection Program is maintained by the HSM and is available if needed. The monitoring procedures and equipment are outlined in Section 6.0 (when applicable).

6.2 Respirator Fit-Test

All Langan employees who may be exposed to hazardous substances at the work site are in possession of a full or half face-piece, air-purifying respirator and have been successfully fit-tested within the past year. Fit-test records are maintained by the HSM.

6.3 Respirator Cartridge Change-Out Schedule

Respiratory protection is required to be worn when certain action levels (table 2) are reached. A respirator cartridge change-out schedule has been developed in order to comply with 29 CFR 1910.134. The respirator cartridge change-out schedule for this project is as follows:

- Cartridges shall be removed and disposed of at the end of each shift, when cartridges become wet or wearer experiences breakthrough, whichever occurs first.
- If the humidity exceeds 85%, then cartridges shall be removed and disposed of after 4 hours of use.

Respirators shall not be stored at the end of the shift with contaminated cartridges left on. Cartridges shall not be worn on the second day, no matter how short the time period was the previous day they were used.

7.0 AIR QUALITY MONITORING AND ACTIONS LEVELS

7.1 Monitoring During Site Operations

Atmospheric air monitoring results may be collected and used to provide data to determine when exclusion zones need to be established and when certain levels of personal protective equipment are required. For all instruments there are Site-specific action level criteria which are used in making field health and safety determinations. Other data, such as the visible presence of contamination or the steady state nature of air contaminant concentration, are also used in making field health and safety decisions. Therefore, the HSO may establish an exclusion zone or require a person to wear a respirator even though atmospheric air contaminant concentrations are below established CHASP action levels.

During site work involving disturbance of petroleum-impacted or fill material, real time air monitoring may be conducted for volatile organic compounds (VOCs). A photoionization detector (PID) and/or flame ionization detector (FID) will be used to monitor concentrations of VOCs at personnel breathing-zone height. Air monitoring will be the responsibility of the HSO or designee. Air monitoring may be conducted during intrusive activities associated with the completion of excavation, debris removal, and soil grading. All manufacturers' instructions for instrumentation and calibration will be available onsite.

Subcontractors' air monitoring plans must be equal or more stringent as the Langan plan.

An air monitoring calibration log is provided in Attachment D of this CHASP.

7.1.1 Volatile Organic Compounds

Monitoring with a PID, such as a MiniRAE 2000 (10.6v) or equivalent may occur during intrusive work in the AOCs. Colorimetric Indicator Tubes for benzene may be used as backup for the PID, if measurements remain above background monitor every 2 hours. The HSO will monitor the employee breathing zone <u>at least</u> every 30 minutes, or whenever there is any indication that concentrations may have changed (odors, visible gases, etc.) since the last measurement. If VOC levels are observed above 5 ppm for longer than 5 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for monitored gases are provided in Table 4.

7.1.2 Metals

Based upon the site historical fill, there is a potential for the soils to contain PAHs and metals. During invasive procedures which have the potential for creating airborne dust, such as excavation of dry soils, a real time airborne dust monitor such as a Mini-Ram may be used to monitor for air particulates. The HSO will monitor the employee breathing zone <u>at least</u> every 30 minutes, or whenever there is any indication that concentrations may have changed (appearance of visible dust) since the last measurement. If dust levels are observed to be greater than 0.100 mg/m³ or visible dust is observed for longer than 15 minutes or if the site PPE is upgraded to Level C, the HSO will begin monitoring the site perimeter at a location downwind of the AOC every 30 minutes in addition to the employee breathing zone. Instrument action levels for dust monitoring are provided in Table 4.

7.2 Monitoring Equipment Calibration and Maintenance

Instrument calibration shall be documented and included in a dedicated safety and health logbook or on separate calibration pages of the field book. All instruments shall be calibrated before and after each shift. Calibration checks may be used during the day to confirm instrument accuracy. Duplicate readings may be taken to confirm individual instrument response.

All instruments shall be operated in accordance with the manufacturers' specifications. Manufacturers' literature, including an operations manual for each piece of monitoring equipment will be maintained on site by the HSO for reference.

7.3 Determination of Background Levels

Background (BKD) levels for VOCs and dust will be established prior to intrusive activities within the AOC at an upwind location. A notation of BKD levels will be referenced in the daily monitoring log. BKD levels are a function of prevailing conditions. BKD levels will be taken in an appropriate upwind location as determined by the HSO.

Table 4 lists the instrument action levels.

8.0 COMMUNITY AIR MONITORING PROGRAM

Community air monitoring may be conducted in compliance with local standards or the generic CAMP outlined below:

Monitoring for dust and odors will be conducted during all ground intrusive activities by the FTL. Continuous monitoring on the perimeter of the work zones for odor, VOCs, and dust may be required for all ground intrusive activities such as soil excavation and handling activities. The work zone is defined as the general area in which machinery is operating in support of remediation activities. A portable PID will be used to monitor the work zone and for periodic monitoring for VOCs during activities such as soil and groundwater sampling and .soil excavation. The site perimeter will be monitored for fugitive dust emissions by visual observations as well as instrumentation measurements (if required). When required, particulate or dust will be monitored continuously with real-time field instrumentation that will meet, at a minimum, the local standards or, default to the performance standards below:

If VOC monitoring is required, the following actions will be taken based on VOC levels measured:

- If total VOC levels exceed 5 ppm above background for the 15-minute average at the perimeter, work activities will be temporarily halted and monitoring continued. If levels readily decrease (per instantaneous readings) below 5 ppm above background, work activities will resume with continued monitoring.
- If total VOC levels at the downwind perimeter of the hot zone persist at levels in excess
 of 5 ppm above background but less than 25 ppm, work activities will be halted, the
 source of vapors identified, corrective actions taken to abate emissions, and monitoring
 continued. After these steps work activities will resume provided that the total organic
 vapor level 200 feet downwind of the hot zone or half the distance to the nearest potential
 receptor or residential/commercial structure, whichever is less but in no case less than
 20 feet, is below 5 ppm above background for the 15-minute average.
- If the total VOC level is above 25 ppm at the perimeter of the hot zone, activities will be shut down.

If dust monitoring with field instrumentation is required, the following actions will be taken based on instrumentation measurements:

- If the downwind particulate level is 100 micrograms per cubic meter (µg/m³) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression must be employed. Work may continue with dust suppression techniques provided that downwind PM10 levels do not exceed 150 µg/m³ above the background level and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 levels are greater than 150 µg/m³ above the background level, work must be stopped and a reevaluation of activities initiated. Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10

concentration to within 150 μ g/m³ of the upwind level and in preventing visible dust migration.

8.1 Dust Suppression Techniques

Preventative measures for dust generation may include wetting site fill and soil, construction of an engineered construction entrance with gravel pad, a truck wash area, covering soils with tarps, and limiting vehicle speeds to five miles per hour.

Work practices to minimize odors and vapors include limiting the time that the excavations remain open, minimizing stockpiling of contaminated-source soil, and minimizing the handling of contaminated material. Offending odor and organic vapor controls may include the application of foam suppressants or tarps over the odor or VOC source areas. Foam suppressants may include biodegradable foams applied over the source material for short-term control of the odor and VOCs.

If odors develop and cannot be otherwise controlled, additional means to eliminate odor nuisances will include: direct load-out of soils to trucks for off-site disposal; use of chemical odorants in spray or misting systems; and, use of staff to monitor odors in surrounding neighborhoods.

Where odor nuisances have developed during remedial work and cannot be corrected, or where the release of nuisance odors cannot otherwise be avoided due to on-site conditions or close proximity to sensitive receptors, odor control will be achieved by sheltering excavation and handling areas under tented containment structures equipped with appropriate air venting/filtering systems.

9.0 WORK ZONES AND DECONTAMINATION

9.1 Site Control

Work zones are intended to control the potential spread of contamination throughout the site and to assure that only authorized individuals are permitted into potentially hazardous areas.

Any person working in an area where the potential for exposure to site contaminants exists will only be allowed access after providing the HSO with proper training and medical documentation.

Exclusion Zone (EZ) - All activities which may involve exposure to site contaminants, hazardous materials and/or conditions should be considered an EZ. Decontamination of field equipment will also be conducted in the Contaminant Reduction Zone (CRZ) which will be located on the perimeter of the EZ. The EZ and the CRZ will be clearly delineated by cones, tapes or other

means. The HSO may establish more than one EZ where different levels of protection may be employed or different hazards exist. The size of the EZ shall be determined by the HSO allowing adequate space for the activity to be completed, field members and emergency equipment.

9.2 Contamination Zone

9.2.1 Personnel Decontamination Station

Personal hygiene, coupled with diligent decontamination, will significantly reduce the potential for exposure.

9.2.2 Minimization of Contact with Contaminants

During completion of all site activities, personnel should attempt to minimize the chance of contact with contaminated materials. This involves a conscientious effort to keep "clean" during site activities. All personnel should minimize kneeling, splash generation, and other physical contact with contamination as PPE is intended to minimize accidental contact. This may ultimately minimize the degree of decontamination required and the generation of waste materials from site operations.

Field procedures will be developed to control over spray and runoff and to ensure that unprotected personnel working nearby are not affected.

9.2.3 Personnel Decontamination Sequence

Decontamination may be performed by removing all PPE used in EZ and placing it in drums/trash cans at the CRZ. Baby wipes should be available for wiping hands and face. Drums/trash canswill be labeled by the field crews in accordance with all local, state, and federal requirements. Management plans for contaminated PPE, and tools are provided below.

9.2.4 Emergency Decontamination

If circumstances dictate that contaminated clothing cannot be readily removed, then remove gross contamination and wrap injured personnel with clean garments/blankets to avoid contaminating other personnel or transporting equipment. If the injured person can be moved, he/she will be decontaminated by site personnel as described above before emergency responders handle the victim. If the person cannot be moved because of the extent of the injury (a back or neck injury), provisions shall be made to ensure that emergency response personnel will be able to respond to the victim without being exposed to potentially hazardous atmospheric conditions. If the potential for inhalation hazards exist, such as with open excavation, this area will be covered with polyethylene sheeting to eliminate any potential inhalation hazards. All emergency personnel are to be immediately informed of the injured person's condition, potential contaminants, and provided with all pertinent data.

9.2.5 Hand-Held Equipment Decontamination

Hand-held equipment includes all monitoring instruments as stated earlier, samples, hand tools, and notebooks. The hand-held equipment is dropped at the first decontamination station to be decontaminated by one of the decontamination team members. These items must be decontaminated or discarded as waste prior to removal from the CRZ.

To aid in decontamination, monitoring instruments can be sealed in plastic bags or wrapped in polyethylene. This will also protect the instruments against contaminants. The instruments will be wiped clean using wipes or paper towels if contamination is visually evident. Sampling equipment, hand tools, etc. will be cleaned with non-phosphorous soap to remove any potentially contaminated soil, and rinsed with deionized water. All decontamination fluids will be containerized and stored on-site pending waste characterization sampling and appropriate off-site disposal.

9.2.6 Heavy Equipment Decontamination

All heavy equipment and vehicles arriving at the work site will be free from contamination from offsite sources. Any vehicles arriving to work that are suspected of being impacted will not be permitted on the work site. Potentially contaminated heavy equipment will not be permitted to leave the EZ unless it has been thoroughly decontaminated and visually inspected by the HSO or his designee.

9.3 Support Zone

The support zone or cold zone will include the remaining areas of the job site. Break areas and support facilities (include equipment storage and maintenance areas) will be located in this zone. No equipment or personnel will be permitted to enter the cold zone from the hot zone without passing through the decontamination station in the warm zone (if necessitated). Eating, smoking, and drinking will be allowed only in this area.

9.4 Communications

The following communications equipment will be utilized as appropriate.

- Telephones A cellular telephone will be located with the HSO for communication with the HSM and emergency support services/facilities.
- Hand Signals Hand signals shall be used by field teams, along with the buddy system. The entire field team shall know them before operations commence and their use covered during site-specific training. Typical hand signals are the following:

Hand Signal	Meaning
Hand gripping throat	Out of air; cannot breathe
Grip partners wrists or place both hands around	Leave immediately without
waist	debate
Hands on top of head	Need assistance
Thumbs up	OK; I'm alright; I understand
Thumbs down	No; negative
Simulated "stick" break with fists	Take a break; stop work

9.5 The Buddy System

When working in teams of two or more, workers will use the "buddy system" for all work activities to ensure that rapid assistance can be provided in the event of an emergency. This requires work groups to be organized such that workers can remain close together and maintain visual contact with one another. Workers using the "buddy system" have the following responsibilities:

- Provide his/her partner with assistance.
- Observe his/her partner for signs of chemical or heat exposure.
- Periodically check the integrity of his/her partner's PPE.
- Notify the HSO or other site personnel if emergency service is needed.

10.0 NEAREST MEDICAL ASSISTANCE

The address and telephone number of the nearest hospital:

Long Island Jewish Forest Hills Hospital 102-01 66th Road Forest Hills, New York 718-830-4000

Map with directions to the hospital are shown in Figure 2. This information will either be posted prominently at the site or will be available to all personnel all of the time. Further, all field personnel, including the HSO & FTL, will know the directions to the hospital.
11.0 STANDING ORDERS/SAFE WORK PRACTICES

The standing orders, which consist of a description of safe work practices that must always be followed while on-site by Langan employees and contractors, are shown in Attachment A. The site HSO and FTL each have the responsibility for enforcing these practices. The standing orders will be posted prominently at the site, or are made available to all personnel at all times. Those who do not abide by these safe work practices will be removed from the site.

12.0 SITE SECURITY

No unauthorized personnel shall be permitted access to the work areas.

13.0 UNDERGROUND UTILITIES

As provided in Langan's Underground Utility Clearance Guidelines, the following safe work practices should be followed by Langan personnel and the contractor before and during subsurface work in accordance with federal, state and local regulations:

- Obtain available utility drawings from the property owner/client or operator.
- Provide utility drawings to the project team.
- In the field, mark the proposed area of subsurface disturbance (when possible).
- Ensure that the utility clearance system has been notified.
- Ensure that utilities are marked before beginning subsurface work.
- Discuss subsurface work locations with the owner/client and contractors.
- Obtain approval from the owner/client and operators for proposed subsurface work locations.
- Use safe digging procedures when applicable.
- Stay at least 10 feet from all equipment performing subsurface work.

14.0 SITE SAFETY INSPECTION

The Langan HSO or alternate will check the work area daily, at the beginning and end of each work shift or more frequently to ensure safe work conditions. The HSO or alternate must complete the Jobsite Safety Inspection Checklist, found in Attachment F. Any deficiencies shall be shared with the FTL, HSM and PM and will be discussed at the daily tailgate meeting.

15.0 HAND AND POWER TOOLS

All hand- and electric-power tools and similar equipment shall be maintained in a safe operating

condition. All electric-power tools must be inspected before initial use. Damaged tools shall be removed immediately from service or repaired. Tools shall be used only for the purpose for which they were designed. All users must be properly trained in their safe operation.

16.0 EMERGENCY RESPONSE

16.1 General

This section establishes procedures and provides information for use during a project emergency. Emergencies happen unexpectedly and quickly, and require an immediate response; therefore, contingency planning and advanced training of staff is essential. Specific elements of emergency support procedures that are addressed in the following subsections include communications, local emergency support units, and preparation for medical emergencies, first aid for injuries incurred on site, record keeping, and emergency site evacuation procedures. In case of emergency, in addition to 911, call *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

Should outside assistance be needed for accidents, fire, or release of hazardous substances, the emergency numbers will be available and posted at the site (Table 5) where a readily accessible telephone is made available for emergency use.

Also, in the event of an incident where a team member becomes exposed or suffers from an acute symptom from contact with site materials and has to be taken to a hospital, a short medical data sheet (Attachment T) for that individual will be made available to the attending physician. The medical data sheet will include the following:

- Name, address, home phone
- Age, height, weight
- Name of person to be notified in case of an accident
- Allergies
- Particular sensitivities
- Does he/she wear contact lenses
- Short checklist of previous illness
- Name of personal physician and phone
- Name of company physician and phone
- Prescription and non-prescription medications currently used.

A sample medical data sheet is included in Attachment T.

16.2 Responsibilities

16.2.1 Health and Safety Officer (HSO)

The HSO is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. The HSO is responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The HSO is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized) so that the HSM can notify OSHA within the required time frame.

16.2.2 Emergency Coordinator

The HSO or their designated alternate will serve as the Emergency Coordinator. The Emergency Coordinator is responsible for ensuring that all personnel are evacuated safely and that machinery and processes are shut down or stabilized in the event of a stop work order or evacuation. They are also responsible for ensuring the HSM are notified of all incidents, all injuries, near misses, fires, spills, releases or equipment damage. The Emergency Coordinator is required to immediately notify the HSM of any fatalities or catastrophes (three or more workers injured and hospitalized.

The Emergency Coordinator shall locate emergency phone numbers and identify hospital routes prior to beginning work on the sites. The Emergency Coordinator shall make necessary arrangements to be prepared for any emergencies that could occur.

The Emergency Coordinator is responsible for implementing the Emergency Response Plan.

16.2.3 Site Personnel

Project site personnel are responsible for knowing the Emergency Response Plan and the procedures contained herein. Personnel are expected to notify the Emergency Coordinator of situations that could constitute a site emergency. Project site personnel, including all subcontractors will be trained in the Emergency Response Plan.

16.3 Communications

Once an emergency situation has been stabilized, or as soon as practically, the injured Langan personnel should contact *Incident Intervention®* at 1-888-479-7787 to report their injuries. For all other communications, contact the Langan Incident Hotline at **(800) 9-LANGAN** (800-952-6426) extension 4699 as soon as possible.

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16.4 Local Emergency Support Units

In order to be able to deal with any emergency that might occur during investigative activities at the site, the Emergency Notification Numbers (Table 5) will be posted and provided to all personnel conducting work within the EZ.

Figure 2 shows the hospital route map. Outside emergency number 911 and local ambulance should be relied on for response to medical emergencies and transport to emergency rooms. Always contact first responders when there are serious or life threatening emergencies on the site. Project personnel are instructed not to drive injured personnel to the Hospital. In the event of an injury, provide first aid and keep the injured party calm and protected from the elements and treat for shock when necessary.

16.5 **Pre-Emergency Planning**

Langan will communicate directly with administrative personnel from the emergency room at the hospital in order to determine whether the hospital has the facilities and personnel needed to treat cases of trauma resulting from any of the contaminants expected to be found on the site. Instructions for finding the hospital will be posted conspicuously in the site office and in each site vehicle.

16.6 Emergency Medical Treatment

The procedures and rules in this CHASP are designed to prevent employee injury. However, should an injury occur, no matter how slight, it will be reported to the HSO immediately. First-aid equipment will be available on site at the following locations:

- First Aid Kit: Contractor Vehicles
- Emergency Eye Wash: Contractor Vehicles

During the site safety briefing, project personnel will be informed of the location of the first aid station(s) that has been set up. Some injuries, such as severe cuts and lacerations or burns, may require immediate treatment. Any first aid instructions that can be obtained from doctors or paramedics, before an emergency-response squad arrives at the site or before the injured person can be transported to the hospital, will be followed closely.

16.7 Personnel with current first aid and CPR certification will be identified.

Only in non-emergency situations may an injured person be transported to an urgent care facility. Due to hazards that may be present at the site and the conditions under which operations are conducted, it is possible that an emergency situation may develop. Emergency situations can be characterized as injury or acute chemical exposure to personnel, fire or explosion, environmental release, or hazardous weather conditions.

16.8 Emergency Site Evacuation Routes and Procedures

All project personnel will be instructed on proper emergency response procedures and locations of emergency telephone numbers during the initial site safety meeting. If an emergency occurs as a result of the site investigation activities, including but not limited to fire, explosion or significant release of toxic gas into the atmosphere, the Langan Project Manager will be verbally notified immediately. All heavy equipment will be shut down and all personnel will evacuate the work areas and assemble at the nearest intersection to be accounted for and to receive further instructions.

In the event that an emergency situation arises, the FTL will implement an immediate evacuation of all project personnel due to immediate or impending danger. The FTL will also immediately communicate with the contractor to coordinate any needed evacuation of the property.

The FTL or Site Supervisor will give necessary instructions until the Designated Incident Commander (IC) assumes control. After the emergency has been resolved, the FTL or Site Supervisor will coordinate with the IC and indicate when staff should resume their normal duties. If dangers are present for those at the designated assembly point, another designated location of assembly will be established.

It will be the responsibility of the FTL or Site Supervisor to report a fire or emergency, assess the seriousness of the situation, and initiate emergency measures until the arrival of the local fire fighters or other first responders, should they be necessary. The FTL, working with emergency responders, may also order the closure of the Site for an indefinite period as long as it is deemed necessary.

Under no circumstances will incoming visitors be allowed to proceed to the area of concern, once an emergency evacuation has been implemented. Visitors or other persons present in the area of the emergency shall be instructed to evacuate the area. The FTL will ensure that access roads are not obstructed and will remain on-site to provide stand-by assistance upon arrival of emergency personnel.

If it is necessary to temporarily control traffic in the event of an emergency, those persons controlling traffic will wear proper reflection warning vests until the arrival of police or fire personnel.

16.8.1 Designated Assembly Locations

All personnel will evacuate the site and assemble at a designated assembly location. The assembly location will be designated by Langan personnel and discussed during each shift's prejob safety briefing.

16.8.2 Accounting for Personnel

All contractor and subcontractor supervisors are responsible for the accounting of all personnel assembled at the designed assembly area. The Designated Incident Commander shall be notified if personnel are not found.

16.9 Fire Prevention and Protection

In the event of a fire or explosion, procedures will include immediately evacuating the site and notification of the Langan Project Manager of the investigation activities. Portable fire extinguishers will be provided at the work zone. The extinguishers located in the various locations should also be identified prior to the start of work. No personnel will fight a fire beyond the stage where it can be put out with a portable extinguisher (incipient stage).

16.9.1 Fire Prevention

Fires will be prevented by adhering to the following precautions:

- Good housekeeping and storage of materials.
- Storage of flammable liquids and gases away from oxidizers.
- Shutting off engines to refuel.
- Grounding and bonding metal containers during transfer of flammable liquids.
- Use of UL approved flammable storage cans.
- Fire extinguishers rated at least 10 pounds ABC located on all heavy equipment, in all trailers and near all hot work activities.

The person responsible for the control of fuel source hazards and the maintenance of fire prevention and/or control equipment is the HSO.

16.10 Significant Vapor Release

Based on the proposed tasks, the potential for a significant vapor release is low. However, if a release occurs, the following steps will be taken:

- Move all personnel to an upwind location. All non-essential personnel shall evacuate.
- Upgrade to Level C Respiratory Protection.

- Downwind perimeter locations shall be monitored for volatile organics.
- If the release poses a potential threat to human health or the environment in the community, the Emergency Coordinator shall notify the Langan Project Manager.
- Local emergency response coordinators will be notified.

16.11 Overt Chemical Exposure

The following are standard procedures to treat chemical exposures. Other, specific procedures detailed on the Material Safety Data Sheet (MSDS) will be followed, when necessary.

SKIN AND EYE: Use copious amounts of soap and water from eye-wash kits and portable hand wash stations.

CONTACT: Wash/rinse affected areas thoroughly, then provide appropriate medical attention. Skin shall also be rinsed for 15 minutes if contact with caustics, acids or hydrogen peroxide occurs. Affected items of clothing shall also be removed from contact with skin.

Providing wash water and soap will be the responsibility of each individual contractor or subcontractor on-site.

16.12 Decontamination during Medical Emergencies

If emergency life-saving first aid and/or medical treatment is required, normal decontamination procedures may need to be abbreviated or omitted. The HSO or designee will accompany contaminated victims to the medical facility to advice on matters involving decontamination when necessary. The outer garments can be removed if they do not cause delays, interfere with treatment or aggravate the problem. Respiratory equipment must always be removed. Protective clothing can be cut away. If the outer contaminated garments cannot be safely removed on site, a plastic barrier placed between the injured individual and clean surfaces should be used to help prevent contamination of the inside of ambulances and/or medical personnel. Outer garments may then be removed at the medical facility. No attempt will be made to wash or rinse the victim if his/her injuries are life threatening, unless it is known that the individual has been contaminated with an extremely toxic or corrosive material which could also cause severe injury or loss of life to emergency response personnel. For minor medical problems or injuries, the normal decontamination procedures will be followed.

16.13 Adverse Weather Conditions

In the event of adverse weather conditions, the HSO will determine if work will continue without potentially risking the safety of all field workers. Some of the items to be considered prior to

determining if work should continue are:

- Potential for heat stress and heat-related injuries.
- Potential for cold stress and cold-related injuries.
- Treacherous weather-related working conditions (hail, rain, snow, ice, high winds).
- Limited visibility (fog).
- Potential for electrical storms.
- Earthquakes.
- Other major incidents.

Site activities will be limited to daylight hours, or when suitable artificial light is provided, and acceptable weather conditions prevail. The HSO will determine the need to cease field operations or observe daily weather reports and evacuate, if necessary, in case of severe inclement weather conditions.

16.14 Spill Control and Response

All small spills/environmental releases shall be contained as close to the source as possible. Whenever possible, the MSDS will be consulted to assist in determining proper waste characterization and the best means of containment and cleanup. For small spills, sorbent materials such as sand, sawdust or commercial sorbents should be placed directly on the substance to contain the spill and aid recovery. Any acid spills should be diluted or neutralized carefully prior to attempting recovery. Berms of earthen or sorbent materials can be used to contain the leading edge of the spills. All spill containment materials will be properly disposed. An exclusion zone of 50 to 100 feet around the spill area should be established depending on the size of the spill.

All contractor vehicles shall have spill kits on them with enough material to contain and absorb the worst-case spill from that vehicle. All vehicles and equipment shall be inspected prior to be admitted on site. Any vehicle or piece of equipment that develops a leak will be taken out of service and removed from the job site.

The following seven steps shall be taken by the Emergency Coordinator:

- 1. Determine the nature, identity and amounts of major spills.
- 2. Make sure all unnecessary persons are removed from the spill area.
- 3. Notify the HSO immediately.
- 4. Use proper PPE in consultation with the HSO.

- 5. If a flammable liquid, gas or vapor is involved, remove all ignition sources and use non-sparking and/or explosion-proof equipment to contain or clean up the spill (diesel-only vehicles, air-operated pumps, etc.)
- 6. If possible, try to stop the leak with appropriate material.
- 7. Remove all surrounding materials that can react or compound with the spill.

In addition to the spill control and response procedures described in this CHASP, Langan personnel will coordinate with the designated project manager relative to spill response and control actions. Notification to the Project Manager must be immediate and, to the extent possible, include the following information:

- Time and location of the spill.
- Type and nature of the material spilled.
- Amount spilled.
- Whether the spill has affected or has a potential to affect a waterway or sewer.
- A brief description of affected areas/equipment.
- Whether the spill has been contained.
- Expected time of cleanup completion. If spill cleanup cannot be handled by Langan's on-site personnel alone, such fact must be conveyed to the Project Manager immediately.

Langan shall not make any notification of spills to outside agencies. The client will notify regulatory agencies as per their reporting procedures.

16.15 Emergency Equipment

The following minimum emergency equipment shall be kept and maintained on site:

- Industrial first aid kit.
- Fire extinguishers (one per site).

16.16 Restoration and Salvage

After an emergency, prompt restoration of utilities, fire protection equipment, medical supplies and other equipment will reduce the possibility of further losses. Some of the items that may need to be addressed are:

- Refilling fire extinguishers.
- Refilling medical supplies.
- Recharging eyewashes and/or showers.
- Replenishing spill control supplies.

16.17 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan Incident/Injury Hotline at 1-(800)-9-LANGAN (ext. #4699) and the client representative to report the incident or near miss. For emergencies involving personnel injury and/or exposure, the HSO and affected employee will complete and submit an Employee Exposure/Injury Incident Report (Attachment C) to the Langan Corporate Health and Safety Manager as soon as possible following the incident.

17.0 SPECIAL CONDITIONS

This guideline contains information and requirements for special conditions that may not be routinely encountered.

17.1 Scope

The guideline applies to the specific projects identified within this document. Additional provisions will be addressed in each Site-Specific Construction Health and Safety Plan (CHASP), as needed.

17.2 Responsibilities

Site Personnel - All site personnel must be alert to safety hazards on work sites and take action to minimize such hazards. Personnel must utilize the buddy system, watch for inappropriate behavior, and be alert to changes in site conditions.

Health and Safety Officer (HSO) - The HSO is responsible for considering these procedures in the development of site specific CHASPs. The HSO shall schedule frequent "tail gate" safety briefings to enhance safety awareness and discuss potential problems.

17.3 Procedures

The procedures outlined below shall be followed when such conditions are encountered.

17.3.1 Ladders

Langan safety procedures shall be used to ensure employee safety when using ladders in the office or work sites. All ladders shall be coated or repaired to prevent injury to the employee from punctures or lacerations and to prevent snagging or clothing. Any wood ladders used must have an opaque covering except for identification or warning labels, which may be placed on one face only of a side rail.

17.3.1.1 Ladder Use

Employees shall only use ladders for the purposes, which they were designed and shall not be used as scaffolding. Ladders will be maintained and inspected prior to use for slip hazards including oil and grease. Employees shall use ladders only on stable and level surfaces unless the ladder is secured to prevent possible displacement. Ladders should not be used on slippery surfaces unless secured or provided with slip resistant feet to prevent accidental displacement. Ladders should not be used in locations where they could be displaced by workplace activities or traffic. Ladder rungs, cleats and steps shall be parallel, level and uniformly spaced when the ladder is in the use position.

Employees should not be carrying anything including equipment that could cause injury if there was a fall while utilizing the ladder. The top and bottom of the ladder area must remain clear while in use. When ascending and descending the ladder, employees must face the ladder.

Ladders shall not be loaded beyond the maximum intended load for which they were built or the manufacturer's rated capacity.

17.3.1.2 Portable Ladders

Rungs, cleats and steps for portable ladders and fixed ladders shall be spaced not less than 10 inches apart, nor more than 14 inches apart, as measured between center lines of the rungs, cleats and steps. When used to access an upper landing surface, the ladder side rails must extend at least three feet above the upper landing surface to which the ladder is used to gain access. If this is not possible, due to the ladders length, then the top of the ladder shall be secured at its top to a rigid support.

17.3.1.3 Step Stools

Rungs, cleats and steps of step stools shall not be less than 8 inches apart, nor more than 12 inches apart, as measured between center lines of the rungs, cleats and steps.

17.3.1.4 Extension Ladders

Rungs, cleats and steps of the base section of extension trestle ladders shall be spaced not less than 8 inches apart, nor more than 18 inches apart, as measured between center lines of the rungs, cleats and steps. The rung spacing on the extension section of the extension trestle ladder shall not be less than 6 inches nor more than 12 inches, as measured between center lines of the rungs, cleats and steps. Ladders shall be used at an angle such that the horizontal distance from the top support to the foot of the ladder is approximately one-quarter of the working length of the ladder (the distance along the ladder between the foot and the top support).

17.3.1.5 Inspection

Ladders will be inspected for visible detects periodically, prior to utilization or after any occurrence that could have negatively affected the ladder. Portable ladders with defects including broken or missing rungs, cleats, or steps, broken or split rails, corroded components or other faulty or defective components shall not be used. The ladder will be immediately marked as defective, tagged as "Do Not Use" or blocked from being used and removed from service until repaired.

17.3.2 First Aid/Cardiopulmonary Resuscitation (CPR)

Langan field and office personnel will be encouraged to be trained in First Aid and Cardiopulmonary Resuscitation (CPR). Training will be provided free of charge by Langan to all employees. Employees will receive a training certificate that will be kept on file with the Health & Safety Coordinator (HSC). Training and certification will be provided by a credited provider such as American Red Cross or equivalent.

17.3.2.1 Emergency Procedures

Prior to work at sites the Langan employees certified in first aid and CPR will be identified in the site specific CHASP. Langan will endear to have at least one employee at a job site trained and able to render first aid and CPR. The site specific CHASP will contain first aid information on both potential chemical and physical hazards. Emergency procedures to be followed are in case of injury or illnesses are provided in the CHASP. The CHASP will include emergency contact information including local police and fire departments, hospital emergency rooms, ambulance services, on-site medical personnel and physicians. The CHASP will also include directions and contact information to the nearest emergency facility in case immediate medical attention is required. The emergency contact information will be conspicuously posted at the worksite. Employees that are injured and require immediate medical attention shall call either 911 or the local posted emergency contacts. Employees should use ambulatory services to transport injured workers to the nearest facility for emergency medical care. In areas where 911 is not available, the telephone numbers of the physicians, hospitals, or ambulances shall be conspicuously posted.

17.3.2.2 First Aid Supplies

First aid supplies are readily available to all Langan employees when required. First aid kits are

located in each Langan office. Portable first aid kits are available for employees to use at work sites. First aid kits should consist of items needed to treat employees for potential chemical and physical injuries. At a minimum, first aid kits should contain items to allow basic first aid to be rendered. Where the eyes or body of an employee may be exposed to corrosive materials, suitable facilities for quick drenching or flushing of the eyes and body shall be provided within the work area for immediate emergency use including eye wash.

First aid kits will be weatherproof with individual sealed packages of each item. All portable first aid kits shall be inspected by Langan employees before and after use to ensure all used items are replaced. When out in the field, employees shall check first aid kits weekly to ensure used items are replaced.

17.3.3 Hydrogen Sulfide

Langan employees with the potential to be exposed to hydrogen sulfide while at work sites shall have training in hydrogen sulfide awareness. The training will include identification of areas where employees could be exposed to hydrogen sulfide, health effects, permissible exposure limits, first aid procedures and personnel protective equipment. Langan employees could be exposed to hydrogen sulfide petroleum refineries, hazardous waste treatment, storage and disposal facilities, uncontrolled hazardous waste sites and remediation projects.

17.3.3.1 Characteristics

Hydrogen sulfide is a colorless gas with a strong odor of rotten eggs that is soluble in water. Hydrogen sulfide is used to test and make other chemicals. It is also found as a by-product of chemical reactions, such as in sewer treatment. It is a highly flammable gas and a dangerous fire hazard. Poisonous gases are produced in fires including sulfur oxides. Hydrogen sulfide is not listed as a carcinogen.

17.3.3.2 Health Effects

Hydrogen Sulfide can affect employees if inhaled or through contact with skin or eyes. Acute (or short term) health effects of hydrogen sulfide exposure include irritation of the nose and throat, dizziness, confusion, headache and trouble sleeping. Inhalation of hydrogen sulfide can irritate the lungs causing coughing and/or shortness of breath. Higher levels of exposure can cause build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic (or long term) health effects of low levels of exposure to hydrogen sulfide can cause pain and redness of the eyes with blurred vision. Repeated exposure may cause bronchitis with cough, phlegm and shortness of breath.

17.3.3.3 Protective Clothing and Equipment

Respirators are required for those operations in which employees will be exposed to hydrogen sulfide above OSHA permissible exposure level. The maximum OSHA permissible exposure limit (PEL) for hydrogen sulfide is 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm) for an 8-hour workday and the maximum short-term exposure limit (STEL) is 10 ppm for any 10-minute period.

Where employees are exposed to levels up to 100 parts of hydrogen sulfide vapor per million parts of air (100 ppm), the following types of respiratory protection are allowed:

- Any powered, air purifying respirator with cartridge(s);
- Any air purifying, full-facepiece respirator (gas mask) with a chin style, front- or backmounted canister;
- Any supplied air system with escape self-contained breathing apparatus, if applicable; and,
- Any self-contained breathing apparatus with a full facepiece.

Respirators used by employees must have joint Mine Safety and Health Administration and the National Institute for Occupational Safety and Health (NIOSH) seal of approval. Cartridges or canisters must be replaced before the end of their service life, or the end of the shift, whichever occurs first. Langan employees that have the potential to be exposed to hydrogen sulfide will be trained in the proper use of respirators. Respirator training is discussed under– Langan's Respiratory Protection Program.

Employees with potential exposure to hydrogen sulfide, or when required by the client, will wear a portable hydrogen sulfide gas detector. The detector should have an audible, visual and vibrating alarm. The detector may also provide detection for carbon monoxide, sulfur dioxide and oxygen deficient atmospheres. The hydrogen sulfide monitor will, at a minimum, be calibrated to detect hydrogen sulfide at a level of 20 parts of hydrogen sulfide vapor per million parts of air (20 ppm). Many portable gas detectors will have factory defaults with a low level alarm at 10 ppm and a high level alarm at 15 ppm. Langan employees shall consult clients to determine if any site specific threshold levels exist.

If the hydrogen sulfide gas detector sounds and employees are not wearing appropriate

respiratory protection, employees must immediately vacate the area and meet at the assigned emergency location. Langan employees may not re- enter the site without proper respiratory protection and approval from the client or property owner, if needed.

Employees shall wear PPE to prevent eye and skin contact with hydrogen sulfide. Employees must wear appropriate protective clothing including boots, gloves, sleeves and aprons, over any parts of their body that could be exposed to hydrogen sulfide. Non-vented, impact resistant goggles should be worn when working with or exposed to hydrogen sulfide.

17.3.3.4 Emergency and First Aid Procedures

Eye and Face Exposure

If hydrogen sulfide comes in contact with eyes, it should be washed out immediately with large amounts of water for 30 minutes, occasionally lifting the lower and upper eye lids. Seek medical attention immediately.

Skin Exposure

If hydrogen sulfide contaminates clothing or skin, remove the contaminated clothing immediately and wash the exposed skin with large amounts of water and soap. Seek medical attention immediately. Contaminated clothing should either be disposed of or washed before wearing again.

Breathing

If a Langan employee or other personnel breathe in hydrogen sulfide, immediately get the exposed person to fresh air. If breathing has stopped, artificial respiration should be started. Call for medical assistance or a doctor as soon as possible.

Safety Precautions

Hydrogen sulfide is a highly flammable gas and a dangerous fire hazard. Containers of hydrogen sulfide may explode in a fire situation. Poisonous gases are produced during fires.

Langan employees should contact property owners and operators prior to conducting work onsite to be aware of any site specific contingency plans, identify where hydrogen sulfide is used at the facility and be informed about additional safety rules or procedures.

19.3.4 Fire Protection/Extinguishers

Langan field personnel that have been provided with portable fire extinguishers for use at worksites will be trained to familiarize employees with general principles of fire extinguisher use and hazards associated with the incipient stage of firefighting. Training will be provided prior to initial assignment for field work and annually thereafter.

Portable fire extinguishers shall be visually inspected monthly and subjected to an annual maintenance check. Langan shall retain records of the annual maintenance date.

17.3.5 Overhead lines

When field work is performed near overhead lines, the lines shall be deenergized and grounded, or other protective measures shall be provided before the work shall commence. If overhead lines are to be deenergized, arrangements shall be made with the client, property owner or organization that operates or controls the electric circuits involved to deenergize and ground them. If protective measures, such as guarding, isolating, or insulating, are provided, these precautions shall prevent employees from contacting such lines directly with any part of their body or indirectly through conductive materials, tools, or equipment.

When unqualified Langan personnel are working in an elevated position near overhead lines, the location shall be such that the person and the longest conductive object they may contact cannot come closer to any unguarded, energized overhead line than the following distances:

- 1. For voltages to ground 50kV or below 10 feet; and
- 2. For voltages to ground over 50kV 10 feet, plus 4 inches for every 10kV over 50kV.

As previously indicated, Langan does not retain qualified employees to perform work on energized equipment.

17.3.5.1 Vehicle and Equipment Clearance

Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines shall be operated so that a clearance of 10 feet is maintained. If the voltage of the overhead lines is higher than 50kV, the clearance shall be increased 4 inches for every 10kV over that voltage.

If any of the following discussed conditions occur, the clearance may be reduced.

• If the vehicle is in transit with its structure lowered, the clearance may be reduced to 4

ft. If the voltage is higher than 50kV, the clearance shall be increased 4 in. for every 10 kV over that voltage.

• If insulating barriers are installed to prevent contact with the lines, and if the barriers are rated for the voltage of the line being guarded and are not a part of or an attachment to the vehicle or its raised structure, the clearance may be reduced to a distance within the designed working dimensions of the insulating barrier.

Employees standing on the ground may not contact the vehicle or mechanical equipment or any of its attachments, unless the employee is using protective equipment rated for the voltage; or the equipment is located so that no uninsulated part of its structure (that portion of the structure that provides a conductive path to employees on the ground) can come closer to the overhead line than permitted.

If any vehicle or mechanical equipment capable of having parts of its structure elevated near energized overhead lines is intentionally grounded, employees working on the ground near the point of grounding may not stand at the grounding location whenever there is a possibility of overhead line contact. Additional precautions, such as the use of barricades or insulation, shall be taken to protect employees from hazardous ground potentials, depending on earth resistivity and fault currents, which can develop within the first few feet or more outward from the grounding point.

17.3.6 Trade Secret

Langan employees could potentially be provided trade secret information by the client or property owner when site specific information is provided about highly hazardous chemicals. Trade secret means any confidential formula, pattern, process, device, information or compilation of information that is used in an employer's business, and that gives the employer an opportunity to obtain an advantage over competitors who do not know or use it. Langan employees understand that this information should be kept confident and if required, may enter into a confidentially agreement with the client.

17.3.7 Bloodborne Pathogens

Langan employees that can reasonably anticipate exposure to blood or other potentially infectious material while at work sites shall have training in bloodborne pathogens. Applicable employees would include those trained in first aid and serving a designated role as an emergency medical care provider. Bloodborne pathogens are pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include, but are not limited to, hepatitis B virus and human immunodeficiency virus.

17.3.7.1 Training

Langan employees with potential occupational exposure to blood or other potentially infectious material must participate in a training program. Training must be conducted prior to initial assignment where there would be potential for exposure and annually thereafter within one year of previous training. The training program will be provided to Langan employees at no cost to them and during working hours.

Langan will ensure the training program shall consist of the following:

- An accessible copy of the regulatory text of 29 CFR 1910.1030 and an explanation of its contents;
- A general explanation of the epidemiology and symptoms of bloodborne diseases;
- An explanation of the modes of transmission of bloodborne pathogens;
- An explanation of Langan's exposure control plan and the means by which the employee can obtain a copy of the written plan;
- An explanation of the appropriate methods for recognizing tasks and other activities that may involve exposure to blood and other potentially infectious materials;
- An explanation of the use and limitations of personal protective
 - equipment (PPE) to prevent and reduce exposure;
 - o Information on the types, proper use, location, removal, handling and disposal of PPE;
 - An explanation of the basis for selection of PPE;
 - Information on the hepatitis B vaccine, including information on its efficacy, safety, method of administration, the benefits of being vaccinated, and that the vaccine and vaccination will be offered free of charge;
 - Information on the appropriate actions to take and persons to contact in an emergency involving blood or other potentially infectious materials;
 - An explanation of the procedure to follow if an exposure incident occurs, including the method of reporting the incident and the medical follow-up that will be made available;
 - o Information on the post-exposure evaluation and follow-up that the
 - employer is required to provide for the employee following an exposure incident;
 - An explanation of the signs and labels and/or color coding required by paragraph 29 CFR 1910.1030(g)(1); and
 - An opportunity for interactive questions and answers with the person conducting the training session.

Langan will develop and implement a written Exposure Control Plan, which will be designed to eliminate or minimize employee exposure to bloodborne pathogens. The Exposure Control Plan

will contain the following elements:

- An exposure determination for employees;
- The schedule and method of implementation for Methods of Compliance (29 CFR 191.1030(d)), Hepatitis B Vaccination and Post-Exposure Evaluation and Follow-up (29 CFR 1910.1030(f)), Communication of Hazards to Employees (29 CFR 1910.1030(g)) and (h) Recordkeeping (29 CFR 1910.1030(h));
- The procedure for the evaluation of circumstances surrounding exposure incidents;
- Ensure a copy of the Exposure Control Plan will be accessible to employees; and,
- The Exposure Control Plan shall be reviewed and updated at least annually.

Langan employees with occupational exposure to bloodborne pathogens include any employees trained in first aid that would be expected to provide emergency medical care. This determination is made without regards to the use of PPE, which could eliminate or minimize exposure.

Universal precautions shall be observed to prevent contact with blood or other potentially infectious materials. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated as if known to be infectious for bloodborne pathogens. Under circumstances in which differentiation between body fluid types is difficult or impossible, all body fluids shall be considered potentially infectious materials.

Work practice controls shall be used to eliminate or minimize employee exposure, if applicable. Since Langan employees will have occupational exposure only during rendering of first aid, personnel protective equipment will be utilized to reduce or minimize exposure. PPE that could be available to Langan personnel when administering first aid includes safety glasses, gloves, and Tyvek suits or sleeves. PPE and first aid kits will be provided to employees at no cost to them.

Langan employees that render first aid in office areas will have access to hand washing facilities or restrooms. For first aid rendered at field locations, first aid kits will contain an appropriate antiseptic hand cleanser and clean cloth/paper towels or antiseptic towelettes. After using antiseptic hand cleansers or towelettes, employees shall wash their hands with soap and running water as soon as feasible.

After administering first aid, potentially infectious materials, including towels, personnel protective equipment, clothes and bandages, shall be placed in a container, which prevents leakage during collection, handling, processing, storage, transport, or shipping. All PPE will be dispose of after use. Any equipment or working surfaces which was been exposed to blood or

potentially infectious materials due to an injury, will be decontaminated prior to reuse.

Langan will make available the hepatitis B vaccine and vaccination series to all employees who have occupational exposure, and post-exposure evaluation and follow-up to all employees who have had an exposure incident. These services will be available to the employee at no cost to them through a medical provider.

17.3.7.2 Recordkeeping

Langan will maintain training and medical records for each employee with occupational exposure to blood or potentially infectious materials. Medical and training records will be maintained by Langan's H&S Department.

Training records will include the following:

- Dates of the training sessions;
- Contents or a summary of the training sessions;
- Names and qualifications of persons conducting the training; and
- Names and job titles of all persons attending the training sessions.

Training records shall be maintained for 3 years from the date on which the training occurred. Medical records will be will be preserved and maintained for the duration of employment plus 30 years.

All records will be made available upon request to employees, the Assistant Secretary of Labor for Occupational Safety and Health, and Director of National Institute for Occupational Safety and Health Director of OSHA for examination and copying. Medical records must have written consent from employee before releasing.

If Langan ceases to do business, all records shall be transferred to the successor employer. The successor employer shall receive and maintain these records.

If there will not be a successor, Langan will notify current employees of their rights to access records at least three months prior to the cessation of business.

18.0 RECORDKEEPING

The following is a summary of required health and safety logs, reports and recordkeeping.

18.1 Field Change Authorization Request

Any changes to the work to be performed that is not included in the CHASP will require an addendum that is approved by the Langan project manager and Langan HSM to be prepared. Approved changes will be reviewed with all field personnel at a safety briefing.

18.2 Medical and Training Records

Copies or verification of training (40-hour, 8-hour, supervisor, site-specific training, documentation of three-day OJT, and respirator fit-test records) and medical clearance for site work and respirator use will be maintained in the office and available upon request. Records for all subcontractor employees must also be available upon request. All employee medical records will be maintained by the HSM.

18.3 Onsite Log

A log of personnel on site each day will be kept by the HSO or designee.

18.4 Daily Safety Meetings ("Tailgate Talks")

Completed safety briefing forms will be maintained by the HSO.

18.5 Exposure Records

All personal monitoring results, laboratory reports, calculations and air sampling data sheets are part of an employee exposure record. These records will be maintained by the HSO during site work. At the end of the project they will be maintained according to 29 CFR 1910.1020.

18.6 Hazard Communication Program/MSDS-SDS

Material safety data sheets (MSDS) of Safety Data Sheets (SDS) have been obtained for applicable substances and are included in this CHASP (Attachment D). Langan's written hazard communication program, in compliance with 29 CFR 1910.1200, is maintained by the HSM.

18.7 Documentation

Immediately following an incident or near miss, unless emergency medical treatment is required, either the employee or a coworker must contact the Langan incident/injury hotline at 1-800-952-6426, extension 4699 and the Project Manager to report the incident or near miss. The Project Manager will contact the client or client representative. A written report must be completed and submitted HSM within 24 hours of the incident. For emergencies involving personnel injury and/or exposure, employee will complete and submit the Langan incident/injury report to the Langan corporate health and safety manager as soon as possible following the incident.

Accidents will be investigated in-depth to identify all causes and to recommend hazard control measures.

18.7.1 Accident and Injury Report Forms

18.7.1.1 Accident/Incident Report

All injuries, no matter how slight, shall be reported to the FTL and the PM immediately. The accident/incident report forms, attached in Attachment U and Attachment V will be filled out on all accidents by the applicable contractor supervision personnel, the FTL, or the HSO. Copies of all accident/incident reports shall be kept on-site and available for review. Project personnel will be instructed on the location of the first aid station, hospital, and doctor and ambulance service near the job. The emergency telephone numbers will be conspicuously posted in site vehicles near the work zone. First aid supplies will be centrally located and conspicuously posted between restricted and non-restricted areas to be readily accessible to all on the site.

18.7.1.2 First Aid Treatment Record

The forms in will be used for recording all non-lost time injuries treated by the project first-aid attendant, the local physician or hospital will be entered in detail on this record. "Minor" treatment of scratches, cuts, etc. will receive the same recording attention as treatment of more severe injuries.

18.7.1.3 OSHA Form 300

An OSHA Form 300 will be kept at the Langan Corporate Office in Parsippany, New Jersey. All recordable injuries or illnesses will be recorded on this form. Subcontractor employers must also meet the requirements of maintaining an OSHA 300 form. The Incident Report form used to capture the details of work-related injuries/illnesses meets the requirements of the OSHA Form 301 (supplemental record) and must be maintained with the OSHA Form 300 for all recordable injuries or illnesses. Forms for recording OSHA work-related injuries and illnesses are included in Attachment U and Attachment V.

19.0 CONFINED SPACE ENTRY

Confined spaces are not anticipated at the Site during planned construction activities. If confined spaces are identified, the contractor must implement their own confined space program that all applicable federal, state and local regulations. Confined spaces <u>will not</u> be entered by Langan personnel.

20.0 CHASP ACKNOWLEDGEMENT FORM

All Langan personnel and contractors will sign this CHASP Compliance Agreement indicating that they have become familiar with this CHASP and that they understand it and agree to abide by it.

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date
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Printed Name	Signature	Company	Date

Printed Name	Signature	Company	Date

TABLES

TABLE 1 TASK HAZARD ANALYSES

Task	Hazard	Description	Control Measures	First Aid
1.3.1 – 1.3.17	Contaminated Soil or Groundwater- Dermal Contact	Contaminated water spills on skin, splashes in eyes; contact with contaminated soil/fill during construction activities or sampling.	Wear proper PPE; follow safe practices, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.17	Lacerations, abrasions, punctures	Cutting bailer twine, pump tubing, acetate liners, etc. with knife; cuts from sharp site objects or previously cut piles, tanks, etc.; Using tools in tight spaces	Wear proper PPE; follow safe practices	Clean wound, apply pressure and/or bandages; seek medical attention as required.
1.3.1 – 1.3.17	Contaminated Media Inhalation	Opening drums, tanks, wells; vapors for non-aqueous phase liquids or other contaminated site media; dust inhalation during excavation; vapor accumulation in excavation	Follow air monitoring plan; have quick access to respirator, do not move or open unlabeled drums found at the site, maintain safe distance from construction activities	See Table 2, seek medical attention as required
1.3.1 – 1.3.17	Lifting	Improper lifting/carrying of equipment and materials causing strains	Follow safe lifting techniques; Langan employees are not to carry contractor equipment or materials	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.17	Slips, trips, and falls	Slips, trips and falls due to uneven surfaces, cords, steep slopes, debris and equipment in work areas	Good housekeeping at site; constant awareness and focus on the task; avoid climbing on stockpiles; maintain safe distance from construction activities and excavations; avoid elevated areas over six feet unless fully accredited in fall protection and wearing an approved fall protection safety apparatus	Rest, ice, compression, elevation; seek medical attention as required
1.3.1 – 1.3.17	Noise	Excavation equipment, hand tools, drilling equipment.	Wear hearing protection; maintain safe distance from construction activities	Seek medical attention as required
1.3.1 – 1.3.17	Falling objects	Soil material, tools, etc. dropping from drill rigs, front-end loaders, etc.	Hard hats to be worn at all times while in work zones; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.17	Underground/ overhead utilities	Excavation equipment, drill rig auger makes contact with underground object; boom touches overhead utility	"One Call" before dig; follow safe practices; confirm utility locations with contractor; wear proper PPE; maintain safe distance from construction activities and excavations	Seek medical attention as required
1.3.1 – 1.3.17	Insects (bees, wasps, hornet, mosquitoes, and spider)	Sings, bites	Insect Repellent; wear proper protective clothing (work boots, socks and light colored pants);field personnel who may have insect allergies (e.g., bee sting) should provide this information to the HSO or FSO prior to commencing work, and will have allergy medication on site.	Seek medical attention as required
1.3.1 – 1.3.17	Vehicle traffic / Heavy Equipment Operation	Vehicles unable to see workers on site, operation of heavy equipment in tight spaces, equipment failure, malfunctioning alarms	Wear proper PPE, especially visibility vest; use a buddy system to look for traffic; rope off area of work with cones and caution tape or devices at points of hazard, maintain safe distance from construction activities and equipment	Seek medical attention as required

TABLE 2CONTAMINANT HAZARDS OF CONCERN

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	1,1'-Biphenyl 1,1-Biphenyl Biphenyl Phenyl benzene Diphenyl	92-52-4	None	1 mg/m [,] 100 mg/m [,]	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, throat; headache, nausea, lassitude (weakness, exhaustion), numb limbs; liver damage	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,2,4,5-Tetramethylbenzene Durene	95-93-2	NA	None None	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	1,2,4-Trimethylbenzene	95-63-6	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	1,2-Dichlorobenzene	95-50-1	PID	50 ppm 200 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eye, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,3,5-Trimethylbenzene Mesitylene sym-Trimethylbenzene	108-67-8	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,3-Butadiene Biethylene Bivinyl Butadiene Divinyl Erythrene Vinylethylene	106-99-0	PID	1 ppm 2000 ppm	Vapor	inhalation, skin and/or eye contact (liquid)	irritation to the eyes, nose, throat; drowsiness, dizziness; liquid: frostbite; teratogenic, reproductive effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	1,4-Dichlorobenzene para- Dichlorobenzene p-Dichlorobenzene 1,4-Dichlorobenzene 1,4-DCB para-Dichlorobenzene p-Dichlorobenzene p-DCB PDB Paramoth Para crystals Paracide Dichlorocide	106-46-7	PID	75 ppm 150 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, swelling periorbital (situated around the eye); profuse rhinitis; headache, anorexia, nausea, vomiting; weight loss, jaundice, cirrhosis; in animals: liver, kidney injury; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	1,4-Dioxane 1,4-Dioxacyclohexane [1,4]Dioxane p-Dioxane [6]-crown-2 Diethylene dioxide Diethylene ether Dioxan Dioxane 1,4-Dioxane	123-91-1	PID	100 ppm 500 ppm	Groundwater Soil Vapor	Inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	2,2,4-Trimethylpentane Isooctane	540-84-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat, respiratory system; bronchitis; hypochromic anemia; headache, drowsiness, lassitude (weakness, exhaustion), dizziness, nausea, incoordination; vomiting, confusion; chemical pneumonitis (aspiration liguid)	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	2-Butanone Ethyl methyl ketone MEK Methyl acetone Methyl ethyl ketone	78-93-3	PID	200 ppm 3000 ppm	Soil Groundwater Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache; dizziness; vomiting; dermatitis	Eye: Irrigate immediately Skin: Water wash immediately Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	2-Methylnaphthalene β-methylnaphthalene	91-57-6	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion or skin absorption, eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract. It may also cause headaches, nausea, vomiting, diarrhea, anemia, jaundice, euphoria, dermatitis, visual disturbances, convulsions and comatose	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	4,4'-DDD Dichlorodiphenyldichloroethan e 1,1'-(2,2-Dichloroethylidene)bis (4-chlorobenzene) p,p'-DDD	72-54-8	None	NA NA	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	 4-Isopropyltoulene 1-Methyl-4-(1- methylethyl)benzene 4-Isopropyltoluene; 4-Methylcumene; 1-Methyl-4-isopropylbenzene Dolcymene Camphogen Paracymene Cymene p-Cymene p-lsopropyltoluene 	99-87-6	PID	NA NA	Soil Groundwater Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Acenaphthene 1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene peri-Ethylenenaphthalene Naphthyleneethylene Tricyclododecapentaene	83-32-9	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact,	irritation to the skin, eyes, mucous membranes and upper respiratory tract; If ingested, it can cause vomiting	Eye: Irrigate immediately Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
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1.3.1 – 1.3.17	Acenaphthylene Cycopental(de)naphthalene, Acenaphthalene	208-96-8	PID	NA NA	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.17	Acetone Dimethyl ketone Ketone propane 2-Propanone	67-64-1	PID	1000 ppm 2500 ppm	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; headache, dizziness, central nervous system depression; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Acetophenone 1-phenylethanone Methyl phenyl ketone Phenylethanone	98-86-2	None	NA NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the skin, eyes, mucous membranes and upper respiratory tract	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, if redness or irritation develop, seek medical attention immediately Breathing: Move to fresh air Swallow: do not induce vomiting, seek medical attention immediately
1.3.1 – 1.3.17	Alpha-Chlordane Alpha Chlordane a-Chlordane	5103-71- 9	None	0.5 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aluminum	7429-90- 5	None	0.5 mg/m3 50 mg/m3	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately Breathing: Fresh air

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Anthracene	120-12-7	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to the skin, eyes, mucous membranes and upper respiratory tract, abdominal pain if ingested.	Eye: Irrigate immediately, seek medical attention immediately, Skin: Soap wash immediately, Breathing: Move to fresh air, refer to medical attention; Swallow: refer to medical attention
1.3.1 – 1.3.17	Antimony	7440-36- 0	None	0.5 mg/m [,] 50 mg/m [,]	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1254	11097- 69-1	None	0.5 mg/m [,] 5 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Aroclor 1260	11096- 82-5	None	0.5 mg/m [,] 5 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Aroclor 1268	11100- 14-4	None	0.5 mg/m [,] 5 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Arsenic	NA	None	0.5 mg/m [,] NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation skin, possible dermatitis; resp distress; diarrhea; muscle tremor, convulsions; possible gastrointestinal tract	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Barium	10022- 31-8	None	0.5 mg/m [,] 50 mg/m [,]	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper respiratory system; skin burns; gastroenteritis; muscle spasm; slow pulse	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Benzene Benzol Phenyl hydride Alkyl benzene isomers	71-43-2	PID	3.19 mg/m [,] 1,595 mg/mg [,]	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, respiratory system; dizziness; headache, nausea, staggered gait; lassitude (weakness, exhaustion) [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	Benzo(a)anthracene Benzanthracene Benzanthrene 1,2-Benzanthracene Benzo[b]phenanthrene Tetraphene	56-55-3	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzo(a)pyrene	50-32-8	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	dermatitis, bronchitis, [potential occupational carcinogen]	Eye: Irrigate immediately, seek medical attention Skin: Soap wash immediately; Breathing: move to fresh air; Swallow: Induce vomiting if conscious, seek medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Benzo(b)fluoranthene	205-99-2	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzo(g,h,i)perylene Benzo(ghi)perylene	191-24-2	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	NA	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzo(k)fluoranthene	207-08-9	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation (dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Benzoic acid Carboxybenzene E210 Dracylic acid Phenylmethanoic acid Benzenecarboxylic acid Benzoic acid isomer	65-85-0	None	NA NA	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Beryllium	7440-41- 7	None	0.002 mg/m [,] 4 mg/m [,]	Soil	inhalation, skin and/or eye contact	berylliosis (chronic exposure): anorexia, weight loss, lassitude (weakness, exhaustion), chest pain, cough, clubbing of fingers, cyanosis, pulmonary insufficiency; irritation to the eyes; dermatitis; [potential occupational carcinogen]	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.17	Bis(2-ethylhexyl)phthalate Bis(2-Ethylhexyl) Phthalate Di-sec octyl phthalate DEHP Di(2-ethylhexyl)phthalate Octyl phthalate bis(2-ethylexyl)phthalate	117-81-7	None	5 mg/m [,] 5000 mg/m [,]	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, mucous membrane; in animals: liver damage; teratogenic effects; [potential occupational carcinogen	Eye: Irrigate immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.17	Cadmium	7440-43- 9	None	0.005 mg/m [,] 9 mg/m [,]	Soil	inhalation, ingestion	pulmonary edema, dyspnea (breathing difficulty), cough, chest tightness, substernal (occurring beneath the sternum) pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; anosmia (loss of the sense of smell), emphysema, proteinuria, mild anemia; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Calcium	7440-70- 2	None	NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, upper resp tract; ulcer, perforation nasal septum; pneumonitis; dermatitis	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Carbazole 9-azafluorene Dibenzopyrrole Diphenylenimine diphenyleneimide	86-74-8	None	NA NA	Soil	inhalation, skin absorption (liquid), skin and/or eye contact	irritation to eyes and skin, respiratory irritation	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Carbon disulfide	75-15-0	PID	20 ppm 500 ppm	Soil Groundwater Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, respiratory system	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.17	Chlordane Chlordan Chlordano 1,2,4,5,6,7,8,8-Octachloro- 3a,4,7,7a-tetrahydro-4,7- methanoindane Total Chlordane	57-74-9	None	0.5 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Chlorobenzene benzene chloride monochlorobenzene Phenyl chloride Chlorobenzol MCB	108-90-7	PID	75 ppm 1000 ppm	Groundwater Soil Vapor	inhalation, skin or eye contact, ingestion	irritation to the eyes, skin, nose; drowsiness, incoordination; central nervous system depression; in animals: liver, lung, kidney injury	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chloroethane Ethyl chloride, Monochloroethane Chlorene Muriatic ether EtCl UN 1037 Hydrochloric ether	75-00-3	PID	1000 ppm 38000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, throat; confusion, dizziness, central nervous system depression; pulmonary edema	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chloroform Methane trichloride Trichloromethane Chloro-3-methyl phenol	67-66-3	None	50 ppm 500 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; dizziness, mental dullness, nausea, confusion; headache, lassitude (weakness, exhaustion); anesthesia; enlarged liver; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Chromium Total Chromium Chromium, Total	7440-47- 3	None	1.0 mg/m [,] 250 mg/m [,]	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Chrysene Benzo[a]phenanthrene 1,2-Benzphenanthrene	218-01-9	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eye, skin, and respiratory, gastrointestinal irritation nausea, vomit, diarrhea [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	cis-1,2-Dichloroethylene cis-1,2-Dichloroethene	156-59-2	NA	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	Irritant to eyes, skin, mucous membranes and respiratory system. May be harmful by ingestion, skin absorption and inhalation	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Cobalt	7440-48- 4	None	0.1mg/m 20 mg/m [,]	Soil	inhalation, ingestion, skin and/or eye contact	Cough, dyspnea (breathing difficulty), wheezing, decreased pulmonary function; weight loss; dermatitis; diffuse nodular fibrosis; resp hypersensitivity, asthma	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Copper	7440-50- 8	None	1.0 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Cumene Cumol Isopropylbenzene 2-Phenyl propane 1-methylethy Ibenzene Isopropyl Benzene	98-82-8	PID	50 ppm 900 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Cyanide	57-12-5	None	5 mg/m [,] 25 mg/m [,]	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	Exposure to cyanide can cause weakness, headaches, confusion, dizziness, fatigue, anxiety, sleepiness, nausea and vomiting. Breathing can speed up then become slow and gasping. Coma and convulsions also occur. If large amounts of cyanide have been absorbed by the body, the person usually collapses and death can occur very quickly. Long-term exposure to lower levels of cyanide can cause skin and nose irritation, itching, rashes and thyroid changes.	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Cyclohexane Benzene hexahydride Hexahydrobenzene Hexamethylene Hexanaphthene	110-82-7	PID	300 ppm 1300 ppm	Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; drowsiness; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	DDE 4,4-DDE 4,4'-DDE 1,1-bis-(4-chlorophenyl)-2,2- dichloroethene Dichlorodiphenyldichloroethyle ne p,p'-DDE	72-55-9	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Oral ingestion of food is the primary source of exposure for the general population. Acute and chronic ingestion may cause nausea, vomiting, diarrhea, stomach pain, headache, dizziness, disorientation, tingling sensation, kidney damage, liver damage, convulsions, coma, and death. 4,4' DDE may cross the placenta and can be excreted in breast milk	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	DDT 4,4-DDT 4,4'-DDT p,p'-DDT Dichlorodiphenyltrichloroethan e 1,1,1-Trichloro-2,2-bis(p- chlorophenyl)ethane	50-29-3	None	1 mg/m [,] 500 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; paresthesia tongue, lips, face; tremor; anxiety, dizziness, confusion, malaise (vague feeling of discomfort), headache, lassitude (weakness, exhaustion); convulsions; paresis hands; vomiting; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Dibenz(a,h)anthracene Dibenzo(a,h)anthracene Dibenzo[a,h]anthracene	53-70-3	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately
1.3.1 – 1.3.17	Dibenzofuran	132-64-9	None	NA NA	Soil	inhalation, absorption	irritation to eyes, and skin	Eyes: Irrigate immediately Skin: Soap wash promptly.
1.3.1 – 1.3.17	Dichlorodifluoromethane Difluorodichloromethane, Fluorocarbon 12 Freon 12 Freon® 12 Genetron® 12 Halon® 122 Propellant 12 Refrigerant 12 Dichlorodifluromethane	75-71-8	None	1000 pp, 15,000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	dizziness, tremor, asphyxia, unconsciousness, cardiac arrhythmias, cardiac arrest; liquid: frostbite	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support
1.3.1 – 1.3.17	Diesel Fuel automotive diesel fuel oil No. 2 distillate diesoline diesel oil diesel oil light diesel oil No. 1-D summer diesel	68334- 30-5	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Ethanol Absolute alcohol Alcohol cologne spirit drinking alcohol ethane monoxide ethylic alcohol EtOH ethyl alcohol ethyl hydrate ethyl hydroxide ethylol grain alcohol hydroxyethane methylcarbinol	64-17-5	PID	1000 ppm 3300 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose; headache, drowsiness, lassitude (weakness, exhaustion), narcosis; cough; liver damage; anemia; reproductive, teratogenic effects	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Ethyl benzene Ethylbenzene Ethylbenzol Phenylethane	100-41-4	PID	435 mg/m [,] 3,472 mg/m [,]	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Fluoranthene Benzo(j,k)fluorene	206-44-0	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Fluorene	86-73-7	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attenti
1.3.1 <i>–</i> 1.3.17	Fuel Oil No. 2	68476- 30-2	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	gamma-Chlordane Gamma Chlordane y-Chlordane	5566-34- 7	None	0.5 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Gasoline	8006-61- 9	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Helium	7440-59- 7	Helium Detector	NA NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 <i>–</i> 1.3.17	Heptane n-Heptane	142-82-5	PID	500 ppm 750 ppm	Goundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	dizziness, stupor, incoordination; loss of appetite, nausea; dermatitis; chemical pneumonitis (aspiration liquid); unconsciousness	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Hexavalent Chromium Chromium VI Chromium, Hexavalent	18540- 29-9	None	1.0 mg/m [,] 250 mg/m [,]	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Indeno(1,2,3-cd)pyrene Indeno(1,2,3-c,d)Pyrene Indeno[1,2,3-cd]Pyrene	193-39-5	None	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, absorption, ingestion, consumption	irritation to eyes, skin, respiratory, and digestion [potential occupational carcinogen]	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support Swallow: Medical attention immediately, wash mouth with water
1.3.1 – 1.3.17	Iron	7439-89- 6	None	10 mg/m [,] NA	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; abdominal pain, diarrhea, vomiting	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	Isopropyl alcohol Iso-Propyl Alcohol Carbinol IPA Isopropanol 2-Propanol sec-Propyl alcohol Rubbing alcohol Isopropylalcohol	67-63-0	PID	400 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; drowsiness, dizziness, headache; dry cracking skin; in animals: narcosis	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Lead	7439-92-	None	0.050 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, ingestion, skin and/or eye contact	lassitude (weakness, exhaustion), insomnia; facial pallor; anorexia, weight loss, malnutrition; constipation, abdominal pain, colic; anemia; gingival lead line; tremor; paralysis wrist, ankles; encephalopathy; kidney disease; irritation to the eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Magnesium	7439-95- 4	None	15 mg/m [,] NA	Soil	inhalation, skin and/or eye contact	irritation to the eyes, skin, respiratory system; cough	Eye: Irrigate immediately Breathing: Fresh air
1.3.1 – 1.3.17	Manganese	7439-96- 5	None	5 mg/m [,] 500 mg/m [,]	Groundwater Soil	inhalation, ingestion	aerosol is irritating to the respiratory tract	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	m-Cresol meta-Cresol 3-Cresol m-Cresylic acid 1-Hydroxy-3-methylbenzene 3-Hydroxytoluene 3-Methylphenol	108-39-4	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Mercury	7439-97- 6	None	0.1 mg/m [,] 10 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, headache, lassitude (weakness, exhaustion); stomatitis, salivation; gastrointestinal disturbance, anorexia, weight loss; proteinuria	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Methyl Bromide Bromomethane Monobromomethane	74-83-9	PID	20 ppm 250 ppm	Soil Groundwater Vapor	inhalation, skin absorption (liquid), skin and/or eye contact (liquid)	irritation to the eyes, skin, respiratory system; muscle weak, incoordination, visual disturbance, dizziness; nausea, vomiting, headache; malaise (vague feeling of discomfort); hand tremor; convulsions; dyspnea (breathing difficulty); skin vesiculation; liquid: frostbite; [potential occupational carcinogen]	Eye: Irrigate immediately (liquid) Skin: Water flush immediately (liquid) Breathing: Respiratory support
1.3.1 – 1.3.17	Methyl Chloride Chloromethane Monochloromethane Refrigerant-40 R-40	74-87-3	NA	100 ppm 2000 ppm	Groundwater Soil	inhalation, skin and/or eye contact	dizziness, nausea, vomiting; visual disturbance, stagger, slurred speech, convulsions, coma; liver, kidney damage; liquid: frostbite; reproductive, teratogenic effects; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Methyl <i>tert</i> -butyl ether MTBE Methyl tertiary-butyl ether Methyl t-butyl ether tert-Butyl methyl ether tBME tert-BuOMe Methyl tert butyl ether	1634-04- 4	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; burning sensation in chest; headache, nausea, lassitude (weakness, exhaustion), restlessness, incoordination, confusion, drowsiness; vomiting, diarrhea; dermatitis; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Methylene Chloride Dichloromethane Methylene dichloride	75-09-2	PID	25 ppm 2300 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin; lassitude (weakness, exhaustion), drowsiness, dizziness; numb, tingle limbs; nausea; [potential occupational carcinogen]	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	m-Xylenes 1,3-Dimethylbenzene m-Xylol Metaxylene	108-38-3 179601- 23-1	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Naphthalene Naphthalin Tar camphor White tar	91-20-3	PID	50 mg/m [,] 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes; headache, confusion, excitement, malaise (vague feeling of discomfort); nausea, vomiting, abdominal pain; irritation bladder; profuse sweating; hematuria (blood in the urine); dermatitis, optical neuritis	Eye: Irrigate immediately Skin: Molten flush immediately/solid- liquid soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	N-ethyl perfluorooctane sulfonamido acetic acid NEtFOSAA N-ethyl perfluorooctane sulfonamido acetic acid (N- EtFOSAA) N- Ethylperfluorooctanesulfonami de N-Ethyl Perfluorooctanesulfonamidoac etic Acid N-ethyl perfluorooctane- sulfonamidoacetic acid N-Ethyl-N- [(heptadecafluorooctyl)sulphon yl]glycine	2991-50- 6	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	n-Hexane Hexane, Hexyl hydride, normal-Hexane	110-54-3	PID	500 ppm 1100 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, nose; nausea, headache; peripheral neuropathy: numb extremities, muscle weak; dermatitis; dizziness; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Nickel	7440-02- 0	None	NA 10 mg/m [,]	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Methane Hydrogen Sulfide Carbon Monoxide Nitrogen	7782-44- 7 74-82-8 7783-08- 4 830-08-0 7727-37- 9	Multi-Gas PID	NA/NA NA/NA 10/100 ppm 50/1200 ppm NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.17	Non-Flammable Gas Mixture CALGAS (Equipment Calibration Gas : Oxygen Isobutylene Nitrogen	7782-44- 7 115-11-7 7727-37- 9	PID	NA/NA NA/NA NA/NA	NA	inhalation	dizziness, headache, and nausea	Breathing: Respiratory support
1.3.1 – 1.3.17	n-Propylbenzene Isocumene Propylbenzene 1-Phenylpropane 1-Propylbenzene Phenylpropane Propylbenzene-n	103-65-1	PID	NA NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin; dry nose, throat; headache; low blood pressure, tachycardia, abnormal cardiovascular system stress; central nervous system, hematopoietic depression; metallic taste; liver, kidney injury	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	o-Cresol ortho-Cresol 2-Cresol o-Cresylic acid 1-Hydroxy-2-methylbenzene 2-Hydroxytoluene 2-Methyl phenol 2-Methylphenol	95-48-7	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediatelyethylp hhhhhhhhh
1.3.1 – 1.3.17	o-Xylenes 1,2-Dimethylbenzene ortho-Xylene o-Xylol	95-47-6 179601- 23-1	PID	100 ppm 900 ppm	Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	p-Cresol para-Cresol 4-Cresol p-Cresylic acid 1-Hydroxy-4-methylbenzene 4-Hydroxytoluene 4-Methylphenol	106-44-5	PID	5 ppm 250 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; central nervous system effects: confusion, depression, resp failure; dyspnea (breathing difficulty), irreg rapid resp, weak pulse; eye, skin burns; dermatitis; lung, liver, kidney, pancreas damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	p-Diethylbenzene 1,4-Diethylbenzene 1,4-Diethyl benzene	105-05-5	PID	None None	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, respiratory system; skin burns; in animals: central nervous system depression	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Pentachlorophenol PCP; Penta; 2,3,4,5,6-Pentachlorophenol	87-86-5	PID	0.5 mg/m [,] 2.5 mg/m [,]	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; sneezing, cough; lassitude (weakness, exhaustion), anorexia, weight loss; sweating; headache, dizziness; nausea, vomiting; dyspnea (breathing difficulty), chest pain; high fever; dermatitis	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorobutanesulfonic acid FC-98 Nonaflate Nonafluorobutanesulphonic acid Perfluorobutanesulfonic Acid Perfluorobutane sulfonate PFBS	375-73-5	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorobutanoic Acid Heptafluorobutyric acid Heptafluorobutanoic acid Perfluorobutyric acid PFBA	375-22-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Perfluorodecanoic acid PFDA	335-76-2	NA	None None	Perfluorohe ptanesulfoni c acid Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorododecanoic acid Perfluoralauric acid Tricosafluorododecanoic acid PFDoA	307-55-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoroheptane sulfonic Acid Perfluoroheptane sulfonate Perfluoroheptanesulfonic acid PFHpS	375-92-8	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoroheptanoic acid Perfluoroheptanoic acid Tridecafluoroheptanoic acid PFHpA	375-85-9	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Perfluorohexanesulfonic Acid perfluorohexanesulfonate perfluorohexanesulfonic acid Perfluorohexane-1- sulphonic acid PFHxS	355-46-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorohexanoic Acid PFHxA	307-24-4	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoronoanoic Acid Perfluorononanoic Acid PFNA perfluoro-n-nonanoic acid perfluorononanoate	375-95-1	NA	None None	Groundwater	Groundwater	inhalation, skin or eye contact, ingestion; strong acid	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorooctanesulfonic Acid PFOS	1763-23-	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Perfluorooctanoic Acid PFOA pentadecafluorooctanoic acid perfluorooctanoate perfluorocaprylic acid	335-67-1	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluoropentanoic Acid PFPeA	2706-90- 3	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Perfluorotetradecanoic Acid PFTA	376-06-7	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 –	Perfluoroundecanoic Acid PFUnA PFUnDA Perfluoroundecanoic Acid Henicosafluoroundecanoic Acid	2058-94- 8	NA	None None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	p-Ethyltoluene 4-Ethyltoluene 1-ethyl-4-methyl-benzene 1-methyl-4-ethylbenzene	622-96-8	NA	NA NA	Soil	ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Phenanthrene	85-01-8	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 – 1.3.17	Phenol Carbolic acid Hydroxybenzene, Monohydroxybenzene Phenyl alcohol Phenyl hydroxide	108-95-2	PID	5 ppm 250 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; anorexia, weight loss; lassitude (weakness, exhaustion), muscle ache, pain; dark urine, skin burns; dermatitis; tremor, convulsions, twitching	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Potassium	7440-09-7	None	NA NA	Soil	inhalation, skin absorption, ingestion, skin and/or eye contact inhalation, ingestion, skin and/or eye contact	eye: Causes eye burns. Skin: Causes skin burns. Reacts with moisture in the skin to form potassium hydroxide and hydrogen with much heat. ingestion: Causes gastrointestinal tract burns. inhalation: May cause irritation of the respiratory tract with burning pain in the nose and throat, coughing, wheezing, shortness of breath and pulmonary edema. Causes chemical burns to the respiratory tract. inhalation may be fatal as a result of spasm, inflammation, edema of the larynx and bronchi, chemical pneumonitis and pulmonary edema.	Eyes: Get medical aid immediately Skin: Get medical aid immediately. Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Ingestion: If victim is conscious and alert, give 2-4 full cups of milk or water. Get medical aid immediately. inhalation: Get medical aid immediately.
1.3.1 – 1.3.17	p-Xylenes 1,4-Dimethylbenzene para-Xylene p-Xylol	106-42-3	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Pyrene benzo[def]phenanthrene	129-00-0	PID	0.2 mg/m [,] 80 mg/m [,] (Coal Pitch Tar)	Groundwater Soil	inhalation, skin or eye contact, ingestion	irritation to eyes and skin, respiratory irritation(dizziness, weakness, fatigue, nausea, headache)	Eye: Irrigate immediately, refer to medical attention Skin: Soap wash immediately Breathing: move to fresh air Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	sec-Butylbenzene 2-phenylbutane	135-98-8	PID	10 ppm 100 ppm	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, throat; inhalation: nausea or vomiting	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Selenium	7782-49- 2	None	1 mg/m [,] 0.2 mg/m [,]	Soil	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; visual disturbance; headache; chills, fever; dyspnea (breathing difficulty), bronchitis; metallic taste, garlic breath, gastrointestinal disturbance; dermatitis; eye, skin burns; in animals: anemia; liver necrosis, cirrhosis; kidney, spleen damage	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Silver	7440-22- 4	None	0.01mg/ m [,] 10 mg/m [,]	Soil	inhalation, ingestion, skin and/or eye contact	blue-gray eyes, nasal septum, throat, skin; irritation, ulceration skin; gastrointestinal disturbance	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Sodium	7440-23- 5	None	NA NA	Groundwater Soil	ion, ingestion, skin and/or eye contact	sensitization dermatitis, allergic asthma, pneumonitis; [potential occupational carcinogen]	Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.17	Sodium 1H,1H,2H,2H- perfluorooctanesulfonate 2-(Perfluorohexyl)ethane-1- sulfonic Acid Sodium Salt ,3,4,4,5,5,6,6,7,7,8,8,8- Tridecafluoro-1-octanesulfonic Acid Sodium Salt; Sodium 1H,1H,2H,2H- perfluoro-1-[1,2-13C2]-octane sulfonate (6:2) Sodium Salt; 3,3,4,4,5,5,6,6,7,7,8,8,8- Tridecafluorooctane-1-sulfonic Acid Sodium Salt; 3,3,4,4,5,5,6,6,7,7,8,8,8- Tridecafluorooctanesulfonic Acid Sodium Salt; 3,3,4,4,5,5,6,6,7,7,8,8,8- Tridecafluorooctanesulfonic Acid Sodium Salt; 6:2 FTS Impurity: Sodium 1H, 1H, 2H, 2H- Perfluorooctane Sulfonic (6:2) Sodium 1H,1H,2H,2H- Perfluorooctane Sulfonate (6:2)	27619- 94-9	NA	None	Groundwater	inhalation, skin or eye contact, ingestion	irritation to eyes with possible eye damage, skin causing rash, redness or burning, irritation to nose, throat and lungs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Styrene Ethenyl benzene Phenylethylene Styrene monomer Styrol Vinyl benzene	100-42-5	PID	100 ppm 700 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose, respiratory system; headache, lassitude (weakness, exhaustion), dizziness, confusion, malaise (vague feeling of discomfort), drowsiness, unsteady gait; narcosis; defatting dermatitis; possible liver injury; reproductive effects	Eye: Irrigate immediately Skin: Water flush Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	Tert-Butyl Alcohol Tertiary Butyl Alcohol Tert-Butanol Butyl alcohol 2-Methyl-2-propanol Trimethyl carbinol TBA	75-65-0	PID	100 ppm 1600 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; drowsiness, narcosis	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	tert-Butylbenzene <i>t</i> -Butylbenzene 2-Methyl-2-phenylpropane Pseudobutylbenzene	98-06-6	PID	10 ppm NA	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	eye, skin irritation; dry nose, throat; headaches; low blood pressure, tachycardia; abnormal cardiovascular system; central nervous system depression; hematopoietic depression	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Tetrahydrofuran Diethylene oxide 1,4-Epoxybutane Tetramethylene oxide THF	109-99-9	PID	200 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, skin and/or eye contact, ingestion	irritation to the eyes, upper respiratory system; nausea, dizziness, headache, central nervous system depression	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immedi
1.3.1 – 1.3.17	Thallium	7440-28- 0	None	0.1 mg/m [,] 15 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Toluene Methyl benzene Methyl benzol Phenyl methane Toluol	108-88-3	PID	200 ppm 500 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, nose; lassitude (weakness, exhaustion), confusion, euphoria, dizziness, headache; dilated pupils, lacrimation (discharge of tears); anxiety, muscle fatigue, paresthesia; dermatitis	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 <i>–</i> 1.3.17	Total PCBs Chlorodiphenyl (42% chlorine) Aroclor® 1242 PCB Polychlorinated biphenyl	53469- 21-9	None	0.5 mg/m [,] 5 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, chloracne	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Total Petroleum Hydrocarbons TPH	143-07-7	PID	NA NA	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions; chemical pneumonitis (aspiration liquid)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	Total Xylenes Dimethylbenzene Xylol	1330-20- 7	PID	100 ppm 900 ppm	Groundwater Soil Vapor	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation to the eyes, skin, nose, throat; dizziness, excitement, drowsiness, incoordination, staggering gait; corneal vacuolization; nausea, vomiting, abdominal pain; dermatitis	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Trans-Chlordane	5103-74- 2	None	0.5 mg/m [,] 100 mg/m [,]	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	Blurred vision; confusion; ataxia, delirium; cough; abdominal pain, nausea, vomiting, diarrhea; irritability, tremor, convulsions; anuria	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Trichlorofluoromethane Fluorotrichloromethane Freon® 11 Monofluorotrichloromethane Refrigerant 11 Trichloromonofluoromethane Freon 11	75-69-4	PID	1000 ppm 2000 ppm	Groundwater Soil Vapor	inhalation, ingestion, skin and/or eye contact	incoordination, tremor; dermatitis; cardiac arrhythmias, cardiac arrest; asphyxia; liquid: frostbite	Eye: Irrigate immediately Skin: Water flush immediately Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Trivalent Chromium Chromium III Chromium, Trivalent	NA	None	1.0 mg/m [,] 250 mg/m [,]	Groundwater Soil	inhalation absorption ingestion	irritation to eye, skin, and respiratory	Eye: Irrigate immediately Skin: Soap wash Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 <i>–</i> 1.3.17	Vanadium	7440-62- 2	None	0.1 mg/m3 15 mg/m3	Groundwater Soil	inhalation, skin absorption, ingestion, skin and/or eye contact	nausea, diarrhea, abdominal pain, vomiting; ptosis, strabismus; peri neuritis, tremor; retrosternal (occurring behind the sternum) tightness, chest pain, pulmonary edema; convulsions, chorea, psychosis; liver, kidney damage; alopecia; paresthesia legs	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
1.3.1 – 1.3.17	Vinyl Chloride Chloroethene Chloroethylen Ethylene monochloride Monochloroethene Monochloroethylene VC Vinyl chloride monomer (VCM)	75-01-4	PID	1 ppm NA	Groundwater Soil Vapor	inhalation, skin and/or eye contact (liquid)	lassitude (weakness, exhaustion); abdominal pain, gastrointestinal bleeding; enlarged liver; pallor or cyanosis of extremities; liquid: frostbite; [potential occupational carcinogen]	Eye: Frostbite Skin: Frostbite Breathing: Respiratory support

Task	Contaminant	CAS Number	Monitoring Device	PEL/ IDLH	Source of Concentration on Site	Route of Exposure	Symptoms	First Aid
1.3.1 – 1.3.17	Zinc	7440-62- 2	None	15 mg/m [,] 500 mg/m [,]	Groundwater Soil	inhalation	chills, muscle ache, nausea, fever, dry throat, cough; lassitude (weakness, exhaustion); metallic taste; headache; blurred vision; low back pain; vomiting; malaise (vague feeling of discomfort); chest tightness; dyspnea (breathing difficulty), rales, decreased pulmonary function	Breathing: Respiratory support`

EXPLANATION OF ABBREVIATIONS

PID = Photoionization Detector

PEL = Permissible Exposure Limit (8-hour Time Weighted Average)

IDLH = Immediately Dangerous to Life and Health

ppm = part per million

 $mg/m^3 = milligrams$ per cubic meter

500 mg/m³
TABLE 3 Summary of Monitoring Equipment

Instrument	Operation Parameters
Photoionization	Hazard Monitored: Many organic and some inorganic gases and vapors.
Detector (PID)	Application: Detects total concentration of many organic and some inorganic gases and
	vapors. Some identification of compounds is possible if more than one probe is measured.
	Detection Method: Ionizes molecules using UV radiation; produces a current that is
	proportional to the number of ions.
	General Care/Maintenance: Recharge or replace battery. Regularly clean lamp window.
	Regularly clean and maintain the instrument and accessories.
	Typical Operating Time: 10 hours. 5 hours with strip chart recorder.
Oxygen Meter	Hazard Monitored: Oxygen (O ₂).
	Application: Measures the percentage of O ₂ in the air.
	Detection Method: Uses an electrochemical sensor to measure the partial pressure of
	O_2 in the air, and converts the reading to O_2 concentration.
	General Care/Maintenance: Replace detector cell according to manufacturer's
	recommendations. Recharge or replace batteries prior to explanation of the specified
	interval. If the ambient air is less than 0.5% C O_2 , replace the detector cell frequently.
	Typical Operating Time: 8 – 12 hours.
Additional equipment (if	needed, based on site conditions)
Combustible Gas	Hazard Monitored: Combustible gases and vapors.
Indicator (CGI)	Application: Measures the concentration of combustible gas or vapor.
	Detection Method: A filament, usually made of platinum, is heated by burning the
	combustible gas or vapor. The increase in heat is measured. Gases and vapors are ionized
	in a flame. A current is produced in proportion to the number of carbon atoms present.
	General Care/Maintenance: Recharge or replace battery. Calibrate immediately before
	use.
	Typical Operating Time: Can be used for as long as the battery lasts, or for the
	recommended interval between calibrations, whichever is less.
Flame Ionization	Hazard Monitored: Many organic gases and vapors (approved areas only).
Detector (FID) with	Application: In survey mode, detects the concentration of many organic gases and
Gas Chromatography	vapors. In gas chromatography (GC) mode, identifies and measures specific compounds.
Option	In survey mode, all the organic compounds are ionized and detected at the same time. In
(i.e., Foxboro Organic	GC mode, volatile species are separated.
Vapor Analyzer (OVA))	General Care/Maintenance: Recharge or replace battery. Monitor fuel and/or
	combustion air supply gauges. Perform routine maintenance as described in the manual.
	Check for leaks.
	Typical Operating Time: 8 hours; 3 hours with strip chart recorder.
Potable Infrared (IR)	Hazard Monitored: Many gases and vapors.
Spectrophotometer	Application: Measures concentration of many gases and vapors in air. Designed to
	quantify one or two component mixtures.
	Detection Method: Passes different frequencies of IR through the sample. The
	frequencies absorbed are specific for each compound.
	General Care/Maintenance: As specified by the manufacturer.

Instrument	Operation Parameters
Direct Reading	Hazard Monitored: Specific gas and vapors.
Colorimetric Indicator	Application: Measures concentration of specific gases and vapors.
Tube	Detection Method: The compound reacts with the indicator chemical in the tube,
	producing a stain whose length or color change is proportional to the compound's concentration.
	General Care/Maintenance: Do not use a previously opened tube even if the indicator
	chemical is not stained. Check pump for leaks before and after use. Refrigerate before
	use to maintain a shelf life of about 2 years. Check expiration dates of tubes. Calibrate
	pump volume at least quarterly. Avoid rough handling which may cause channeling.
Aerosol Monitor	Hazard Monitored: Airborne particulate (dust, mist, fume) concentrations
	Application: Measures total concentration of semi-volatile organic compounds, PCBs, and
	metals.
	Detection Method: Based on light-scattering properties of particulate matter. Using an
	internal pump, air sample is drawn into the sensing volume where near infrared light
	scattering is used to detect particles.
	General Care/Waintenance: As specified by the mir. Also, the instrument must be
	in the emplored with particulates of a size and refractive index similar to those to be measured
Monitov	In the amplent all.
WORLOX	Application: Measures specific cases and vanors
	Detection Method: Electrochemical sensor relatively specific for the chemical species in
	question
	General Care/Maintenance: Moisten sponge before use: check the function switch:
	change the battery when needed.
Gamma Radiation	Hazard Monitored: Gamma Radiation.
Survey Instrument	Application: Environmental radiation monitor.
	Detection Method: Scintillation detector.
	General Care/Maintenance: Must be calibrated annually at a specialized facility.
	Typical Operating Time: Can be used for as long as the battery lasts, or for the
	recommended interval between calibrations, whichever is less.

TABLE 3 **INSTRUMENTATION ACTION LEVELS**

Photoionization Detector Action Levels	Action Required
Background to 5 parts per million (ppm) ¹	No respirator needed; no further action
>5ppm but = 15 ppm at the perimeter of the work area</td <td> Work temporarily halted and monitoring continues If instantaneous readings decrease below 5 ppm above background, work activities will resume with continued monitoring </td>	 Work temporarily halted and monitoring continues If instantaneous readings decrease below 5 ppm above background, work activities will resume with continued monitoring
>5ppm but = 25 ppm at the downwind perimeter of the hot zone</td <td> Work activities will be halted Source of vapors identified Corrective actions taken to abate emissions Continued monitoring Workers will don appropriate respirators and work can resume if vapor levels 200 feet downind or the hot zone or half the distance to the nearest potential receptor or residential or commercial structure, whichever is less – but in no case less than 20 feet – is below 5 ppm above background for the 15-minute average </td>	 Work activities will be halted Source of vapors identified Corrective actions taken to abate emissions Continued monitoring Workers will don appropriate respirators and work can resume if vapor levels 200 feet downind or the hot zone or half the distance to the nearest potential receptor or residential or commercial structure, whichever is less – but in no case less than 20 feet – is below 5 ppm above background for the 15-minute average
>25ppm at the parameter of the hot zone	Activities will shut down

Particulate Monitoring Action Levels	Action Required			
Background to 100 micrograms per cubic meter $(\mu g/m^3)^2$, no dust observed	No further action			
Background to 100 µg/m ³ , dust observed leaving the work area	Dust suppression must be employed			
100 to 150 μg/m ³ at the downwind parameter of the hot zone	 Work activities will be halted Source of dust identified Dust suppression activities initiated Corrective actions taken to abate emissions Continued monitoring Workers will don appropriate respirators Work can resume provided that dust suppression measures and other controls are successful in reducing the downwind PM10 concentration to within 150 µg/m³ of the upwind level and in preventing visible dust migration. 			
>150 µg/m ³ at the parameter of the hot zone	Activities will shut down			

 ¹ VOC concentrations are 15-minute averages above site background (upwind parameter)
 ² Particulate concentrations are 15-minute averages above site background (upwind parameter)

TABLE 5EMERGENCY NOTIFICATION LIST

ORGANIZATION	CONTACT	TELEPHONE
Local Police Department	NYPD	911
Local Fire Department	NYFD	911
Ambulance/Rescue Squad	NYFD	911
Hospital	Long Island Jewish Forest Hills Hospital	911 or 718-830-4000
Langan Incident Hotline		800-952-6426 ex 4699
Medical Treatment Hotline	Incident Intervention	888-449-7787
Langan Environmental Project Manager	Stuart Knoop	917-941-5461 (cell)
Langan Geotechnical Project Manager	Samuel Singer	718-810-4121 (cell)
Langan Site/Civil Project Manager	Kelly Tuffs	646-265-8010 (cell)
Langan Health and Safety Manager (HSM)	Tony Moffa	215-756-2523 (cell)
Langan Health & Safety Officer (HSO)	William Bohrer	410-984-3068 (cell)
Langan Field Team Leader (FTL)	To Be Determined	
Client's Representative	Frank Bonura	212-894-7964
National Response Center (NRC)		800-424-8802
Chemical Transportation Emergency Center (Chemtrec)		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Poison Control Center		800-222-1222

Immediately following an injury, unless immediate emergency medical treatment is required, the injured employee must contact <u>Incident</u> <u>Intervention®</u> at 888-449-7787.

For all other incidents or near misses, unless emergency response is required, either the employee or a coworker must contact the Langan Incident Hotline at 1-(800)-9-LANGAN (ext. #4699).

TABLE 6SUGGESTED FREQUENCY OF PHYSIOLOGICAL MONITORINGFOR FIT AND ACCLIMATED WORKERS^A

Adjusted	Normal Work	Impermeable			
Temperature ^b	Ensemble ^c	Ensemble			
90°F or above	After each 45 min.	After each 15 min.			
(32.2°C) or above	of work	of work			
87.5°F	After each 60 min.	After each 30 min.			
(30.8°-32.2°C)	of work	of work			
82.5°-87.5°F	After each 90 min.	After each 60 min.			
(28.1°-30.8°C)	of work	of work			
77.5°-82.5°F	After each 120 min.	After each 90 min.			
(25.3°-28.1°C)	of work	of work			
72.5°-77.5°F	After each 150 min.	After each 120 min.			
(22.5°-25.3°C)	of work	of work			

a For work levels of 250 kilocalories/hour.

b Calculate the adjusted air temperature (ta adj) by using this equation: ta adj OF = ta OF + (13 x % sunshine). Measure air temperature (ta) with a standard mercury-in-glass thermometer, with the bulb shielded from radiant heat. Estimate percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

c A normal work ensemble consists of cotton coveralls or other cotton clothing with long sleeves and pants.

TABLE 7

HEAT INDEX

			ENVI	RONMENT	AL TEMPE	RATURE (F	-ahrenheit)				
	70	75	80	85	90	95	100	105	110	115	120
RELATIVE											
HUMIDITY					APPARE	NT TEMPE	RATURE*				
0%	64	69	73	78	83	87	91	95	99	103	107
10%	65	70	75	80	85	90	95	100	105	111	116
20%	66	72	77	82	87	93	99	105	112	120	130
30%	67	73	78	84	90	96	104	113	123	135	148
40%	68	74	79	86	93	101	110	123	137	151	
50%	69	75	81	88	96	107	120	135	150		
60%	70	76	82	90	100	114	132	149			
70%	70	77	85	93	106	124	144				
80%	71	78	86	97	113	136					
90%	71	79	88	102	122						
100%	72	80	91	108		-					

*Combined Index of Heat and Humidity...what it "feels like" to the body Source: National Oceanic and Atmospheric Administration

How to use Heat Index:

- 1. Across top locate Environmental Temperature
- 2. Down left side locate Relative Humidity
- 3. Follow across and down to find Apparent Temperature
- 4. Determine Heat Stress Risk on chart at right

Note: Exposure to full sunshine can increase Heat Index values by up to 15 degrees F.

Apparent Temperature	Heat Stress Risk with Physical Activity and/or Prolonged				
	Exposure				
90-105	Heat Cramps or Heat				
	Exhaustion Possible				
105-130	Heat Cramps or Heat Exhaustion				
	Likely, Heat Stroke Possible				
>130	Heatstroke Highly Likely				

FIGURES

FIGURE 1

Site Location Map



FIGURE 2 HOSPITAL ROUTE PLAN

Hospital Location: Long Island Jewish Forest Hills Hospital 102-01 66th Road Forest Hills, New York 718-830-4000

START: Rego Park III, Rego Park, New York

- 1. From 93-30 93rd Street, head southeast toward Junction Blvd
- 2. Turn right onto Junction Blvd
- 3. Turn right onto 62nd Drive
- 4. Turn left at the 2nd cross street onto Queens Blvd
- 5. Turn left onto 67th Ave
- 6. Turn left onto 102nd St, destination will be on the right.

END: Long Island Jewish Forest Hills Hospital, 102-01 66th Road, Forest Hills, New York



ATTACHMENT A

STANDING ORDERS

STANDING ORDERS

GENERAL

- No smoking, eating, or drinking in this work zone.
- Upon leaving the work zone, personnel will thoroughly wash their hands and face.
- Minimize contact with contaminated materials through proper planning of work areas and decontamination areas, and by following proper procedures. Do not place equipment on the ground. Do not sit on contaminated materials.
- No open flames in the work zone.
- Only properly trained and equipped personnel are permitted to work in potentially contaminated areas.
- Always use the appropriate level of personal protective equipment (PPE).
- Maintain close contact with your buddy in the work zone
- Contaminated material will be contained in the Exclusion Zone (EZ).
- Report any unusual conditions.
- Work areas will be kept clear and uncluttered. Debris and other slip, trip, and fall hazards will be removed as frequently as possible.
- The number of personnel and equipment in the work zone will be kept to an essential minimum.
- Be alert to the symptoms of fatigue and heat/cold stress, and their effects on the normal caution and judgment of personnel.
- Conflicting situations which may arise concerning safety requirements and working conditions must be addressed and resolved quickly by the site HSO.

TOOLS AND HEAVY EQUIPMENT

- Do not, under any circumstances, enter or ride in or on any backhoe bucket, materials hoist, or any other device not specifically designed to carrying passengers.
- Loose-fitting clothing or loose long hair is prohibited around moving machinery.
- Ensure that heavy equipment operators and all other personnel in the work zone are using the same hand signals to communicate.
- Drilling/excavating within 10 feet in any direction of overhead power lines is prohibited.
- The locations of all underground utilities must be identified and marked out prior to initiating any subsurface activities.
- Check to insure that the equipment operator has lowered all blades and buckets to the ground before shutting off the vehicle.
- If the equipment has an emergency stop device, have the operator show all personnel its location and how to activate it.
- Help the operator ensure adequate clearances when the equipment must negotiate in tight quarters; serve as a signalman to direct backing as necessary.
- Ensure that all heavy equipment that is used in the Exclusion Zone is kept in that zone until the job is done, and that such equipment is completely decontaminated before moving it into the clean area of the work zone.
- Samplers must not reach into or get near rotating equipment such as the drill rig. If personnel must work near any tools that could rotate, the equipment operator must completely shut down the rig prior to initiating such work. It may be necessary to use a remote sampling device.

ATTACHMENT B

DECONTAMINATION PROCEDURES

Station 1:	Equipment Drop	 Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	2. Scrub outer boots, outer gloves and chemical-re- sistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	3. Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Canister or Mask Change	 If worker leaves Exclusion Zone to change canister (or mask), this is the last step in the decontamination procedure. Worker's canister is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	 Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Face piece Removal	6. Face piece is removed (avoid touching face with fingers). Face piece deposited on plastic sheets.
Station 7:	Field Wash	 Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL C DECONTAMINATION

LEVEL **D** DECONTAMINATION

Station 1:	Equipment Drop	 Deposit equipment used on-site (tools, sampling devices and containers, monitoring instruments, radios, clipboards, etc.) on plastic drop cloths. Segregation at the drop reduces the probability of cross contamination. During hot weather operations, cool down stations may be set up within this area.
Station 2:	Outer Garment, Boots, and Gloves Wash and Rinse	 Scrub outer boots, outer gloves and chemical-re- sistant splash suit with decon solution or detergent and water. Rinse off using copious amounts of water.
Station 3:	Outer Boot and Glove Removal	 Remove outer boots and gloves. Deposit in container with plastic liner.
Station 4:	Boot, Gloves and Outer Garment Removal	 Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 5:	Field Wash	5. Hands and face are thoroughly washed. Shower as soon as possible.

EQUIPMENT DECONTAMINATION

GENERAL:

Equipment to be decontaminated during the project may include tools, monitoring equipment, respirators, sampling containers, laboratory equipment and drilling equipment.

All decontamination will be done by personnel in protective gear, appropriate for the level of decontamination, as determined by the site HSO. The decontamination work tasks will be split or rotated among support and work crews.

Depending on site conditions, backhoe and pumps may be decontaminated over a portable decontamination pad to contain wash water; or, wash water may be allowed to run off into a storm sewer system. Equipment needed may include a steam generator with high-pressure water, empty drums, screens, screen support structures, and shovels. Drums will be used to hold contaminated wash water pumped from the lined pit. These drums will be labeled as such.

Miscellaneous tools and equipment will be dropped into a plastic pail, tub, or other container. They will be brushed off and rinsed with a detergent solution, and finally rinsed with clean water.

MONITORING EQUIPMENT:

Monitoring equipment will be protected as much as possible from contamination by draping, masking, or otherwise covering as much of the instruments as possible with plastic without hindering the operation of the unit. The PID, HNu or OVA meter, for example, can be placed in a clear plastic bag, which allows reading of the scale and operation of knobs. The probes can be partially wrapped keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings removed and disposed in the appropriate containers. Any dirt or obvious contamination will be brushed or wiped with a disposable paper wipe.

RESPIRATORS:

Respirators will be cleaned and disinfected after every use. Taken from the drop area, the masks (with the cartridges removed and disposed of with other used disposable gear) will be immersed in a cleaning solution and scrubbed gently with a soft brush, followed by a rinse in plain warm water, and then allowed to air dry. In the morning, new cartridges will be installed. Personnel will inspect their own masks for serviceability prior to donning them. And, once the mask is on, the wearer will check the respirator for leakage using the negative and positive pressure fit check techniques.

ATTACHMENT C

EMPLOYEE EXPOSURE/ INJURY INCIDENT REPORT

EMPLOYEE INCIDENT/INJURY REPORT LANGAN ENGINEERING & ENVIRONMENTAL SERVICES

(Complete and return to Tony Moffa in the Doylestown Office)

Affected Employee	Name:				Da	te:		
Incident type:		Injury Near Miss		Report Only Other:	//No Inji	ury		
EMPLOYEE INFO	RMATION	(Person com	oleting Form	,				
Employee Name: _ No:				_	En	nployee		
Title:				Off	ice			Location:
_ength o	f	time	employed	or		date	of	hire:
<i>A</i> ailing								address:
Gex: M F F	Birth extension:	date:		Res	sidence/	/cell		phone:
ACCIDENT INFOR	MATION							
Project:					Pro	oject		#:
Date & time of inci	dent:			Time v	vork	started	&	ended:
								location:

Names incident:		of	person(s	5)		who		witnessed		the
Exact		location			incident					occurred:
Describe done:				- -	vork					being
Describe	what	affected	employee	was	doing	prior	to	the	incident	occurring:
Describe occurred:		in	in detai		l how			the	incident	
Nature affected):	of	the	incident	(List	t	he	parts	of	the	body
Person(s)	to	whom	incident	: w	vas	report	ed	(Time	and	Date):

List the names of other persons affected during this incident:

Possible	e causes	of	the	incident	(equipn	nent,	unsafe	work	practice	s, lack	c of	PPE,	etc.):
Weathe incident	eather conditions during during during								during				
MEDICA	AL CARE I	NFOF	MAT	<u>ION</u>									
Did affe	cted empl	oyee ı	eceive	e medical o	care?		Yes 🗌		No 🗌				
	If received:_	Yes,		when	an	ıd	whe	re	was	r	nedica	I	care
	Provide		nam	e	of	fao	cility	(†	nospital,		clinic,		etc.):
	Length			of	st	taγ		at		the		f	acility?
Did the	employee	miss	any w	ork time?	Yes 🗌	No	U U	ndeterr	nined 🗌				
Date en work:	nployee las	st wor	ked: _				C	Date	emplo	yee	retu	urned	to
Has the	employee	e retur	ned to	work?	Yes 🗌	No							
Does th	e employe	e hav	e any	work limita	ations or	restrict	tions fror	n the ir	njury?:	Yes 🗌		No 🗌]
	lf			Yes	,			plea	ase			de	scribe:
Did the	exposure/	injury	result	in perman	ent disab	ility?	Yes 🗌		No 🗌		Unkno	wn 🗌	
	lf			Yes	,			plea	ise			de	scribe:

HEALTH & SAFETY INFORMATION

Was the o	peration bei	ing conducted under an established site specific CONSTRU(CTION HEALTH AND SAFETY
PLAN?			
Yes 🗌	No 🗌	Not Applicable: 🗌	

Describe protective equipment and clothing used by the employee:

Did any limitations in safety equipment or protective clothing contribute to or affect exposure / injury? If so, explain:

Employee Signature

Date

Date

ATTACHMENT D

PROJECT:_____

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

PROJECT:_____

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

PROJECT:_____

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

PROJECT:_____

Date & Time	Inst Type	Inst #	Media	Initial Reading	Span #	Calibrat. Reading	Performed By:

ATTACHMENT E

MATERIAL SAFETY DATA SHEETS

SAFETY DATA SHEETS

All Langan Field Personnel Completing This Work Plan Are To Have Real Time Accessibility To Material Safety Data Sheet (MSDs) or Safety Data Sheet (SDSs) Through Their Smart Phone.

The link is <u>http://www.msds.com/</u> The login name is "drapehead" The password is "2angan987"

If You Are Unable To Use the Smart Phone App, You Are To Bring Printed Copies of the MSDs/SDSs to the Site

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.10 Revision Date 01/28/2016 Print Date 02/18/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Biphenyl	
	Product Number Brand Index-No.	:	W312908 Aldrich 601-042-00-8	
	CAS-No.	:	92-52-4	

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Warning
Hazard statement(s) H315 H319 H335 H410	Causes skin irritation. Causes serious eye irritation. May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.
Precautionary statement(s) P261 P264 P271	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. Wash skin thoroughly after handling. Use only outdoors or in a well-ventilated area.

P273 P280 P302 + P352 P304 + P340 + P312	Avoid release to the environment. Wear protective gloves/ eye protection/ face protection. IF ON SKIN: Wash with plenty of soap and water. IF INHALED: Remove person to fresh air and keep comfortable for
	breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₁₂ H ₁₀
Molecular weight	:	154.21 g/mol
CAS-No.	:	92-52-4
EC-No.	:	202-163-5
Index-No.	:	601-042-00-8

Hazardous components

ation	Concentration
2; Eye Irrit. 2A; E 3; Aquatic Acute 1; Chronic 1; H315, 335, H410	<= 100 %
<u>335</u>	5, H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Biphenyl	92-52-4	TWA	0.2 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Pulmonary fu	Inction	
		TWA	0.200000 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Pulmonary fu	Inction	

TWA	0.2 ppm 1 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
TWA	0.200000 ppm 1.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
The value in	mg/m3 is approxir	nate.
TWA	0.2 ppm 1 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
The value in	mg/m3 is approxir	nate.
TWA	0.200000 ppm 1.000000 mg/m3	USA. NIOSH Recommended Exposure Limits

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: butyl-rubber Minimum layer thickness: 0.3 mm Break through time: 480 min Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 30 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: light yellow
b)	Odour	characteristic
c)	Odour Threshold	No data available
d)	рН	5.5
e)	Melting point/freezing point	Melting point/range: 68 - 70 °C (154 - 158 °F) - lit.
f)	Initial boiling point and boiling range	255 °C (491 °F) - lit.
g)	Flash point	110 °C (230 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	The product is not flammable Flammability (solids)
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 5.8 %(V) Lower explosion limit: 0.6 %(V)
k)	Vapour pressure	0.04 hPa (0.03 mmHg) at 20 °C (68 °F) 5.5 hPa (4.1 mmHg) at 100 °C (212 °F) 12.6 hPa (9.5 mmHg) at 115 °C (239 °F) 95.7 hPa (71.8 mmHg) at 166 °C (331 °F)
I)	Vapour density	No data available
m)	Relative density	0.992 g/cm3
n)	Water solubility	0.0075 g/l at 15 °C (59 °F)
o)	Partition coefficient: n- octanol/water	log Pow: 4.008 at 25 °C (77 °F)
p)	Auto-ignition temperature	566 °C (1,051 °F) at 1,013.0 hPa (759.8 mmHg)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	ner safety information data available	

10. STABILITY AND REACTIVITY

10.1	Reactivity			
	No data available			

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Inhalation: No data available

LD50 Dermal - Rabbit - > 5,010 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Irritating to skin. - 24 h (Draize Test)

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

Maximisation Test (GPMT) - Guinea pig Does not cause skin sensitisation. (OECD Test Guideline 406)

Germ cell mutagenicity

Ames test S. typhimurium Result: negative

Mouse - male and female Result: negative

Carcinogenicity

Carcinogenicity - Mouse - Oral Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Lungs, Thorax, or Respiration:Tumors. Blood:Tumors.

Carcinogenicity - Mouse - Subcutaneous Tumorigenic:Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration:Tumors. Liver:Tumors.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: DU8050000 Liver injury may occur., Gastrointestinal disturbance

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

	Toxicity to fish	flow-through test LC50 - Pimephales promelas (fathead minnow) - 3 mg/l - 96 h (OECD Test Guideline 203)
	Toxicity to daphnia and other aquatic invertebrates	flow-through test EC50 - Daphnia magna (Water flea) - 0.36 mg/l - 48 h
12.2	Persistence and degrad Biodegradability	lability aerobic - Exposure time 14 d Result: 84 % - Readily biodegradable (OECD Test Guideline 301C)
12.3	Bioaccumulative potent	tial

Bioaccumulation Leuciscus idus (Golden orfe) - 3 d - 50 μg/l

Bioconcentration factor (BCF): 281

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Biphenyl) Reportable Quantity (RQ): 100 lbs Marine pollutant:yes Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Biphenyl) Marine pollutant:yes IATA UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Biphenyl)

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels establish	ed by SARA Title III, CAS-No.	Section 313: Revision Date
Biphenyl	92-52-4	2007-07-01
SARA 311/312 Hazards Acute Health Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Biphenyl	92-52-4	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Biphenyl	92-52-4	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Biphenyl	92-52-4	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information

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Preparation Information Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.10

Revision Date: 01/28/2016

Print Date: 02/18/2016



SAFETY DATA SHEET

Version 6.5 Revision Date 05/02/2022 Print Date 05/14/2022

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

	Product name :		1,2,4,5-Tetramethylbenzene	
	Product Number Brand CAS-No.	::	T19607 Aldrich 95-93-2	
1.2	Relevant identified uses of the substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Synthesis of substances	

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
reiephone	:	+1 314 //1-5/65
Fax	:	+1 800 325-5052
Emorgoney tolonhono		

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable solids (Category 1), H228 Short-term (acute) aquatic hazard (Category 1), H400 Long-term (chronic) aquatic hazard (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word



Danger

Hazard statement(s) H228

Flammable solid.

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The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada



H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	: Durene 1,2,4,5-Tetramethy	ylbenzene	
Formula Molecular weight CAS-No. EC-No.	: C ₁₀ H ₁₄ : 134.22 g/mol : 95-93-2 : 202-465-7		
Component		Classification	Concentration
1,2,4,5-tetramethylbenzene			
		Flam. Sol. 1; Aquatic Acute 1; Aquatic Chronic 1; H228, H400, H410 M-Factor - Aquatic Acute: 1 - Aquatic Chronic: 1	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower.

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In case of eye contact

After eye contact: rinse out with plenty of water. Remove contact lenses.

If swallowed

After swallowing: make victim drink water (two glasses at most). Consult doctor if feeling unwell.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Combustible.

Vapors are heavier than air and may spread along floors. Forms explosive mixtures with air on intense heating. Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

In the event of fire, wear self-contained breathing apparatus.

5.4 Further information

Remove container from danger zone and cool with water. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid inhalation of dusts. Avoid substance contact. Ensure adequate ventilation. Keep away from heat and sources of ignition. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains. Risk of explosion.

- **6.3 Methods and materials for containment and cleaning up** Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up dry. Dispose of properly. Clean up affected area. Avoid generation of dusts.
- **6.4** Reference to other sections For disposal see section 13.

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SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on protection against fire and explosion

Keep away from open flames, hot surfaces and sources of ignition. Take precautionary measures against static discharge.

Hygiene measures

Change contaminated clothing. Wash hands after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Keep away from heat and sources of ignition.

Storage class

Storage class (TRGS 510): 4.1B: Flammable solid hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Change contaminated clothing. Wash hands after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:KCL 741 Dermatril® L

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:KCL 741 Dermatril® L

Body Protection

Flame retardant antistatic protective clothing.

Respiratory protection

required when dusts are generated.

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Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains. Risk of explosion.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystals		
b)	Odor	No data available		
c)	Odor Threshold	No data available		
d)	рН	No data available		
e)	Melting point/freezing point	Melting point/range: 76 - 80 °C (169 - 176 °F) - lit.		
f)	Initial boiling point and boiling range	191 - 193 °C 376 - 379 °F		
g)	Flash point	74 °C (165 °F) - c.c.		
h)	Evaporation rate	No data available		
i)	Flammability (solid, gas)	The substance or mixture is a flammable solid with the category 1.		
j)	Upper/lower flammability or explosive limits	No data available		
k)	Vapor pressure	No data available		
I)	Vapor density	No data available		
m)	Density	0.838 g/mL at 25 °C (77 °F) - lit.		
	Relative density	No data available		
n)	Water solubility	No data available		
o)	Partition coefficient: n-octanol/water	No data available		
p)	Autoignition temperature	No data available		
q)	Decomposition temperature	No data available		
r)	Viscosity	No data available		
s)	Explosive properties	No data available		
t)	Oxidizing properties	none		
Oth	Other safety information			

No data available

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SECTION 10: Stability and reactivity

10.1 Reactivity

Forms explosive mixtures with air on intense heating. A range from approx. 15 Kelvin below the flash point is to be rated as critical. The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with: Oxidizing agents

10.4 Conditions to avoid

Strong heating.

10.5 Incompatible materials No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 6,700 mg/kg Remarks: (RTECS) Inhalation: No data available Dermal: No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitization No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

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Reproductive toxicity

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

11.2 Additional Information

RTECS: DC0500000 The data available to us do not suffice to permit any industrial-toxicological assessment.

Further toxicological data:

Risk of absorption.

Other dangerous properties can not be excluded.

Further data:

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

12.2	Persistence and deg	radability		
	Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.47 mg/l - 48 h Remarks: (External MSDS)		
		LC100 - Leuciscus idus (Golden orfe) - 50 mg/l - 48 h Remarks: (ECOTOX Database)		
		LC50 - Leuciscus idus (Golden orfe) - 30 mg/l - 48 h Remarks: (ECOTOX Database)		
	Toxicity to fish	LC0 - Leuciscus idus (Golden orfe) - 10 mg/l - 48 h Remarks: (ECOTOX Database)		

Not readily biodegradable.

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

No data available

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12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties No data available

12.7 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

UN number: 1325 Class: 4.1 Packing group: II Proper shipping name: Flammable solids, organic, n.o.s. (1,2,4,5-tetramethylbenzene) Reportable Quantity (RQ): Poison Inhalation Hazard: No

IMDG

UN number: 1325 Class: 4.1 Packing group: II EMS-No: F-A, S-G Proper shipping name: FLAMMABLE SOLID, ORGANIC, N.O.S. (1,2,4,5-tetramethylbenzene) Marine pollutant : yes

ΙΑΤΑ

UN number: 1325 Class: 4.1 Packing group: II Proper shipping name: Flammable solid, organic, n.o.s. (1,2,4,5-tetramethylbenzene)

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

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No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components 1,2,4,5-tetramethylbenzene	CAS-No. 95-93-2	Revision Date
New Jersey Right To Know Components 1,2,4,5-tetramethylbenzene	CAS-No. 95-93-2	Revision Date

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.5

Revision Date: 05/02/2022

Print Date: 05/14/2022

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MATERIAL SAFETY DATA SHEET

	Section 1 - Chemical Product and Company Identification		
MSDS Name:	1,2,4-Trimethylbenzene		
Catalog Numbers:	AC140090000, AC140090010, AC1	40090025, AC140095000	
Synonyms:	Pseudocumene.		
Company Identification:		Acros Organics BVBA Janssen Pharmaceuticalaan 3a 2440 Geel, Belgium	
Company Identification: (USA)		Acros Organics One Reagent Lane Fair Lawn, NJ 07410	
For information in the US, call:		800-ACROS-01	
For information in Europe, call:		+32 14 57 52 11	
Emergency Number, Europe:		+32 14 57 52 99	
Emergency Number US:		201-796-7100	
CHEMTREC Phone Number, US:		800-424-9300	
CHEMTREC Phone Number, Europe:		703-527-3887	
Section 2 - Composition, Information on Ingredients			

CAS#:	95-63-6
Chemical Name:	1,2,4-Trimethylbenzene
%:	98
EINECS#:	202-436-9

Hazard Symbols:



Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. Harmful if inhaled. Causes eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Target Organs: Blood, central nervous system, respiratory system, eyes, skin.

Potential Health Effects

- Eye: Causes eye irritation. Causes redness and pain.
- Skin: Causes skin irritation. Causes redness and pain. May be harmful if absorbed through the skin.
- Ingestion: May cause irritation of the digestive tract. Aspiration of material into the lungs may cause chemical pneumonitis, which may be fatal. May be harmful if swallowed. May cause central nervous system depression.
- Inhalation: Harmful if inhaled. Causes respiratory tract irritation. May cause drowsiness, unconsciousness, and central nervous system depression.
- Chronic: Prolonged or repeated skin contact may cause dermatitis. May cause anemia and other blood cell abnormalities. Prolonged exposure may produce a narcotic effect. Prolonged or repeated exposure may cause nausea, dizziness, and headache.

	Section 4 - First Aid Measures			
Eyes:	es: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.			
Skin: Get medical aid. Immediately flush skin with plenty of water for at least 15 minutes while removir contaminated clothing and shoes.				
Ingestion:	Do not induce vomiting. Possible aspiration hazard. Get medical aid immediately. Call a poison control center.			
Inhalation:	Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Possible aspiration hazard. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.			
Notes to Physician:				
	Section 5 - Fire Fighting Measures			
General Information	As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Vapors may form an explosive mixture with air. Vapors can travel to a source of ignition and flash back. Will burn if involved in a fire. Containers may explode in the heat of a fire. Flammable liquid and vapor.			
Extinguishiı Media:	ng Use water spray to cool fire-exposed containers. Use water spray, dry chemical, carbon dioxide, or chemical foam.			
Autoig Tempera	nition 500 deg C (932.00 deg F) ature:			
Flash F Expl Limits: L	Point: 48 deg C (118.40 deg F) osion 0.9 vol % ower:			
Expl Limits: U	osion 6.4 vol % pper:			
	ating: nearth. 2, nammability. 2, instability. 0,			
	Section 6 - Accidental Release Measures			
General Information	Use proper personal protective equipment as indicated in Section 8.			
Spills/Leaks	Absorb spill with inert material (e.g. vermiculite, sand or earth), then place in suitable container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Remove all sources of ignition. Use a spark-proof tool. Do not let this chemical enter the environment.			
	Section 7 - Handling and Storage			
Handling: U in	se spark-proof tools and explosion proof equipment. Do not get in eyes, on skin, or on clothing. Do not ogest or inhale. Use only in a chemical fume hood. Keep away from heat, sparks and flame.			
Storage: Keep away from sources of ignition. Store in a cool, dry place. Store in a tightly closed container. Flammables-area.				
	Section 8 - Exposure Controls, Personal Protection			

4			+	++
	Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
	1,2,4-Trimethylbenz ene	25 ppm TWA (listed under Trimethyl benzene).	25 ppm TWA; 125 mg/m3 TWA	none listed
+				++

OSHA Vacated PELs: 1,2,4-Trimethylbenzene: 25 ppm TWA; 125 mg/m3 TWA (listed under Trimethyl benzene) **Engineering Controls:**

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin: Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Clear liquid Color: colorless Odor: aromatic odor pH: Not available Vapor Pressure: 7 mm Hg @ 44.4 deg C Vapor Density: 4.15 (air=1) Evaporation Rate: Not available Viscosity: Not available Boiling Point: 168 deg C @ 760 mmHg (334.40°F) Freezing/Melting Point: -44 deg C (-47.20°F) Decomposition Temperature: Not available Solubility in water: Insoluble Specific Gravity/Density: 0.880 g/cm3 Molecular Formula: C9H12 Molecular Weight: 120.19

Section 10 - Stability and Reactivity			
Chemical Stability: Stable under normal temperatures and pressures.			
Conditions to Avoid:	Incompatible materials, ignition sources, excess heat.		
Incompatibilities with Other Materials	Strong oxidizing agents.		
Hazardous Decomposition Products	Carbon monoxide, carbon dioxide.		
Hazardous Polymerization Will not occur.			
Section 11 - Toxicological Information			

Section 11 - Toxicological Information

RTECS#:	TECS#: CAS# 95-63-6: DC3325000		
LD50/LC50: RTECS: CAS# 95-63-6: Inhalation, rat: LC50 = 18000 mg/m3/4H; Oral, mouse: LD50 = 6900 mg/kg; Oral, rat: LD50 = 5 gm/kg;			
Carcinogenicity:	1,2,4-Trimethylbenzene - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.		
Other:	See actual entry in RTECS for complete information.		
Section 12 - Ecological Information			
Ecotoxicity: F	Ecotoxicity: Fish: Fathead Minnow: LC50 = 77.2 mg/L; 96 Hr; Flow-through at 25 C (pH 7.24)		
Other:	Other: Do not empty into drains.		
Section 13 - Disposal Considerations			
Dispose of in a manner consistent with federal, state, and local regulations.			
Section 14 - Transport Information			
DOT pping Name: FLAMMABLE LIQUIDS, N.O.S. (1,2,4-Trimethylbenzene)			

US

Sh Hazard Class: 3 UN Number: UN1993 Packing Group: III Canada TDG

Shipping Name: Not available Hazard Class: UN Number: Packing Group:

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN N

Risk Phrases:

R 10 Flammable.

R 20 Harmful by inhalation.

R 36/37/38 Irritating to eyes, respiratory system and skin.

R 51/53 Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Safety Phrases:

S 26 In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

S 61 Avoid release to the environment. Refer to special instructions/safety data sheets.

WGK (Water Danger/Protection)

CAS# 95-63-6: 3

Canada

CAS# 95-63-6 is listed on Canada's DSL List

Canadian WHMIS Classifications: B3, D1B, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations. CAS# 95-63-6 is listed on Canada's Ingredient Disclosure List

US Federal

TSCA

CAS# 95-63-6 is listed on the TSCA Inventory.

Section 16 - Other Information

MSDS Creation Date: 5/19/1999 Revision #5 Date 8/30/2007

Revisions were made in Sections: 3, 4, 5, 6, 7, 8, 9, 10, 11, 1

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantibility or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

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SAFETY DATA SHEET

against

Version 4.7 Revision Date 11/26/2015 Print Date 02/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	1,2-Dichlorobenzene
	Product Number Brand Index-No.	:	240664 Sigma-Aldrich 602-034-00-7
	CAS-No.	:	95-50-1
1.2	Relevant identified uses	s of the	e substance or mixture and uses advised aga
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 4), H227 Acute toxicity, Oral (Category 4), H302 Acute toxicity, Inhalation (Category 4), H332 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Skin sensitisation (Category 1), H317 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Hazard statement(s) H227 H302 + H332 H315 H317 H319 Warning

Combustible liquid. Harmful if swallowed or if inhaled Causes skin irritation. May cause an allergic skin reaction. Causes serious eye irritation.

H335 H410	May cause respiratory irritation. Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P272	Contaminated work clothing should not be allowed out of the workplace.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you
	feel unwell. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for
	breathing. Call a POISON CENTER or doctor/ physician if you feel
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
D000 - D040	contact lenses, if present and easy to do. Continue rinsing.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P337 + P313	If eye initiation persists: Get medical advice/ attention.
P302 D270 + D279	have on contaminated clothing and wash before reuse.
P3/0 + P3/6	extinguish.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₆ H ₄ Cl ₂
Molecular weight	:	147.00 g/mol
CAS-No.	:	95-50-1
EC-No.	:	202-425-9
Index-No.	:	602-034-00-7

Hazardous components

Component	Classification	Concentration
1,2-Dichlorobenzene		
	Flam. Liq. 4; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H227, H302 + H332, H315, H317, H319, H335, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13). Keep in suitable, closed containers for disposal.

6.4 Reference to other sections For disposal see section 13.

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Light sensitive.

Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis	
			parameters		
1,2-Dichlorobenzene	95-50-1	TWA	25.000000 ppm	USA. ACGIH Threshold Limit Values	
,				(TLV)	
	Remarks	Upper Respi	ratory Tract irritation	on	
		Eve irritation			
		Liver damage	е		
		Not classifiat	ole as a human cai	rcinogen	
		TWA	25 ppm	USA. ACGIH Threshold Limit Values	
				(TLV)	
		Upper Respi	ratory Tract irritatio	on	
		Eye irritation	•		
		Liver damage	е		
		Not classifiat	ole as a human cai	rcinogen	
		STEL	50.000000 ppm	USA. ACGIH Threshold Limit Values	
				(TLV)	
		Upper Respi	ratory Tract irritatio	on	
		Eye irritation			
		Liver damage			
		Not classifiat	ole as a human cai	rcinogen	
		STEL	50 ppm	USA. ACGIH Threshold Limit Values	
				(TLV)	
		Upper Respi	ratory Tract irritatio	n	
		Eye irritation	-		
		Liver damage	е		
		Not classifiat	ole as a human cai	cinogen	
		С	50.000000 ppm	USA. Occupational Exposure Limits	
			300.000000	(OSHA) - Table Z-1 Limits for Air	
			mg/m3	Contaminants	
		The value in	mg/m3 is approxin	nate.	
		Ceiling limit i	s to be determined	from breathing-zone air samples.	
		С	50.000000 ppm	USA. NIOSH Recommended	
			300.000000	Exposure Limits	
			mg/m3		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M) Splash contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 38 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -1817 °C (0 - 1 °F) - lit.
f)	Initial boiling point and boiling range	178 - 180 °C (352 - 356 °F) - lit.
g)	Flash point	66.0 °C (150.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 9.2 %(V) Lower explosion limit: 2.2 %(V)
k)	Vapour pressure	2.1 hPa (1.6 mmHg) at 35.0 °C (95.0 °F) 1.6 hPa (1.2 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	1.306 g/cm3 at 25 °C (77 °F)
n)	Water solubility	ca.0.1558 g/l at 25 °C (77 °F) - partly soluble
o)	Partition coefficient: n- octanol/water	log Pow: ca.3.433 at 25 °C (77 °F)
p)	Auto-ignition temperature	648.0 °C (1,198.4 °F)
q)	Decomposition	No data available

temperature

r) Viscosity No data available s) Explosive properties No data available t) Oxidizing properties No data available Other safety information

Surface tension ca 36 61 mN/m

10. STABILITY AND REACTIVITY

Reactivity 10.1

9.2

No data available

- 10.2 Chemical stability Stable under recommended storage conditions.
- 10.3 Possibility of hazardous reactions No data available
- 10.4 Conditions to avoid Heat, flames and sparks.
- Incompatible materials 10.5 Strong oxidizing agents
- 10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 500.0 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - > 10,000 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit (OECD Test Guideline 404)

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

in vivo assay - Mouse May cause sensitisation by skin contact. (OECD Test Guideline 429)

Germ cell mutagenicity No data available

Ames test Salmonella typhimurium **Result:** negative

OECD Test Guideline 474 Mouse - male - Bone marrow Result: negative

Carcinogenicity

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (1,2-Dichlorobenzene)

- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure

Aspiration hazard No data available

Additional Information

Repeated dose
toxicityRat - male and female - Oral - 24 h - NOAEL : 60 mg/kg - LOAEL : 125 mg/kg -
OECD Test Guideline 408RTECS: CZ450000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

	Toxicity to fish	flow-through test LC50 - Oncorhynchus mykiss (rainbow trout) - 1.58 mg/l - 96 h	
	Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Ceriodaphnia dubia (water flea) - 0.66 mg/l - 48 h	
	Toxicity to algae	Growth inhibition EC50 - Pseudokirchneriella subcapitata - 2.2 mg/l - 96 h	
12.2	Persistence and degrad Biodegradability	ability aerobic - Exposure time 28 d Result: 0 % - Not readily biodegradable. (OECD Test Guideline 301C)	
12.3	3 Bioaccumulative potential		
	Bioaccumulation	Cyprinus carpio (Carp) - 56 d - 0.01 mg/l	
		Bioconcentration factor (BCF): 90 - 260 (OECD Test Guideline 305C)	
12.4	Mobility in soil		

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1591 Packing group: III Class: 6.1 Proper shipping name: o-Dichlorobenzene Reportable Quantity (RQ): 100 lbs Poison Inhalation Hazard: No IMDG UN number: 1591 Class: 6.1 Packing group: III EMS-No: F-A, S-A Proper shipping name: ortho-DICHLOROBENZENE Marine pollutant:yes ΙΑΤΑ UN number: 1591 Packing group: III Class: 6.1 Proper shipping name: o-Dichlorobenzene

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels esta	blished by SARA Tit	tle III, Section 313:
	CAS-No.	Revision Date
1,2-Dichlorobenzene	95-50-1	2007-07-01
SARA 311/312 Hazards		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
1,2-Dichlorobenzene	95-50-1	2007-07-01

Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
1,2-Dichlorobenzene	95-50-1	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
1,2-Dichlorobenzene	95-50-1	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Acute toxicity

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H227	Combustible liquid.
H302	Harmful if swallowed.
H302 + H332	Harmful if swallowed or if inhaled
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	2
Physical Hazard	1
NEDA Bating	

NFPA Rating

Health hazard:	2
Fire Hazard:	2
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.7

Revision Date: 11/26/2015

Print Date: 02/11/2016

SIGMA-ALDRICH

Material Safety Data Sheet

Version 3.1 Revision Date 04/08/2011 Print Date 12/27/2011

1. PRODUCT AND COMPANY ID	DENT	IFICATION
Product name	:	1,3,5-Trimethylbenzene
Product Number Brand	:	442236 Supelco
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Combustible Liquid, Target Organ Effect, Irritant

Target Organs

Peripheral nervous system., Central nervous system, Blood

GHS Classification

Flammable liquids (Category 3) Acute toxicity, Inhalation (Category 5) Skin irritation (Category 2) Eye irritation (Category 2B) Specific target organ toxicity - single exposure (Category 3) Acute aquatic toxicity (Category 2) Chronic aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)	
H226	Flammable liquid and vapour.
H315 + H320	Causes skin and eye irritation.
H333	May be harmful if inhaled.
H335	May cause respiratory irritation.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s)P261Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.P273Avoid release to the environment.P305 + P351 + P338IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if
present and easy to do. Continue rinsing.

HMIS Classification	
Health hazard:	2
Chronic Health Hazard:	*
Flammability:	2
Physical hazards:	0
NFPA Rating	
Health hazard:	2
Fire:	2
Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms	: Mesitylene 1,3,5-Trimethylk	penzene		
Formula Molecular Weight	: C ₉ H ₁₂ : 120.19 g/mol			
CAS-No.	EC-No.	Index-No.	Concentration]
Mesitylene				
108-67-8	203-604-4	601-025-00-5	-]

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Special protective equipment for fire-fighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control	Basis
			parameters	
Mesitylene	108-67-8	TWA	25 ppm 125 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	25 ppm 123 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		TWA	25 ppm 125 mg/m3	USA. NIOSH Recommended Exposure Limits

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

impervious clothing, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form

liquid, clear

Colour	colourless
Safety data	
рН	no data available
Melting point/freezing point	Melting point/range: -45 °C (-49 °F) - lit.
Boiling point	163 - 166 °C (325 - 331 °F) - lit.
Flash point	53.0 °C (127.4 °F) - closed cup
Ignition temperature	e 550 °C (1,022 °F)
Autoignition temperature	550.0 °C (1,022.0 °F)
Lower explosion lim	it 0.88 %(V)
Vapour pressure	18.7 hPa (14.0 mmHg) at 55.0 °C (131.0 °F) 3.3 hPa (2.5 mmHg) at 25.0 °C (77.0 °F)
Density	0.864 g/cm3 at 25 °C (77 °F)
Water solubility	no data available
Partition coefficient: n-octanol/water	no data available
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions no data available

Conditions to avoid Heat, flames and sparks.

Materials to avoid Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50 Inhalation LC50 LC50 Inhalation - rat - 4 h - 24,000 mg/m3

Dermal LD50 no data available

Other information on acute toxicity no data available

Skin corrosion/irritation Skin - rabbit - Skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - rabbit - Mild eye irritation - 24 h

Respiratory or skin sensitization no data available

Germ cell mutagenicity

no data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System) May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System) no data available

Aspiration hazard no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	May be harmful if absorbed through skin. Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Synergistic effects no data available

Additional Information

RTECS: OX6825000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fishLC50 - Carassius auratus (goldfish) - 12.52 mg/l - 96.0 hToxicity to daphnia
and other aquatic
invertebrates.Immobilization EC50 - Daphnia magna (Water flea) - 6 mg/l - 48 h

Persistence and degradability no data available

Bioaccumulative potential

no data available

Mobility in soil no data available

PBT and vPvB assessment

no data available

Other adverse effects

Toxic to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2325 Class: 3 Packing group: III Proper shipping name: 1,3,5-Trimethylbenzene Marine pollutant: No Poison Inhalation Hazard: No

IMDG

UN number: 2325 Class: 3 Packing group: III Proper shipping name: 1,3,5-TRIMETHYLBENZENE Marine pollutant: No

EMS-No: F-E, S-D

ΙΑΤΑ

UN number: 2325 Class: 3 Packing group: III Proper shipping name: 1,3,5-Trimethylbenzene

15. REGULATORY INFORMATION

OSHA Hazards

Combustible Liquid, Target Organ Effect, Irritant

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Mesitylene	CAS-No. 108-67-8	Revision Date
Mesitylene	100 07 0	1334 04 01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Mesitylene	108-67-8	1994-04-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Mesitylene	108-67-8	1994-04-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

Copyright 2011 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Version 4.6 Revision Date 03/03/2015 Print Date 03/03/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	1 3-Butadiene		
	Product Number	:	295035		
	Brand	:	Aldrich		
	Index-No.	:	601-013-00-X		
	CAS-No.	:	106-99-0		
1.2	Relevant identified uses of the substance or mixture and uses advised against				
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		
1 /	Emergency telephone nur	nho	r		

1.4 Emergency telephone number

Emergency Phone #	: ((314)	776-6555
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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable gases (Category 1), H220 Gases under pressure (Liquefied gas), H280 Germ cell mutagenicity (Category 1B), H340 Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Hazard statement(s)	
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H340	May cause genetic defects.
H350	May cause cancer.
Precautionary statement(s	s)
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P281	Use personal protective equipment as required.

P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.
P405	Store locked up.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	С ₄ Н ₆
Molecular weight	:	54.09 g/mol
CAS-No.	:	106-99-0
EC-No.	:	203-450-8
Index-No.	:	601-013-00-X

Hazardous components

Component	Classification	Concentration
1,3-Butadiene		
	Flam. Gas 1; Press. Gas Liquefied gas; Muta. 1B; Carc. 1A; H220, H280, H340, H350	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

- 6.3 Methods and materials for containment and cleaning up Clean up promptly by sweeping or vacuum.
- 6.4 Reference to other sections For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature 2 - 8 °C

Contents under pressure. Air sensitive. Light sensitive. Shock or heat may detonate May explode when heated. Handle and store under inert gas. Storage class (TRGS 510): Gases

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis	
	Remarks	Potential Occupational Carcinogen See Appendix A			
1,3-Butadiene	106-99-0	TWA	2 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		Cancer Suspected h	uman carcinogen		
		TWA	2.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)	
Cancer					
		Suspected human carcinogen			
		TWA	1 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		Substance listed; for more information see OSHA document 29 CF 1910.1051; 29 CFR 1910.19(1)			
		TWA	1.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		Substance lis 1910.1051; 2	Substance listed; for more information see OSHA document 29 CFI 1910.1051; 29 CFR 1910.19(1)		

STEL	5 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
Substance lis 1910.1051; 2	sted; for more info 29 CFR 1910.19(1)	mation see OSHA document 29 CFR
STEL	5.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
Substance lis 1910.1051; 2	sted; for more info 29 CFR 1910.19(1)	rmation see OSHA document 29 CFR
See 1910.10	51	
PEL	1.000000 ppm	OSHA Specifically Regulated Chemicals/Carcinogens
1910.1051		
This section	applies to all occu	pational exposures to 1,3-Butadiene
(BD), Chemi	cal Abstracts Serv	ice Registry No. 106-99-0, except as
provided in p	paragraph (a)(2) of	this section. Except for the
recordkeepir	ng provisions in pa	ragraph (m)(1) of this section, this
products cor	the provide the providence of	ber work operations and streams in
which BD is	present where obj	ective data are reasonably relied upon
that demons	trate the work ope	ration or the product or the group of
products or o	pperations to which	n it belongs may not reasonably be
foreseen to r	elease BD in airbo	orne concentrations at or above the
action level of	or in excess of the	STEL under the expected conditions
of processing	g, use, or handling	that will cause the greatest possible
release or in	any plausible acci	dent. This section also does not
apply to wor	RD is from liquid r	nixtures containing 0.1% or less of BD
by volume of	the vapors releas	ed from such liquids unless objective
data become	available that sho	by that airborne concentrations
generated by	y such mixtures ca	n exceed the action level or STEL
under reasor	nably predictable c	onditions of processing, use or
handling that	t will cause the gre	atest possible release. Except for
labeling requ	irements and requ	irements for emergency response,
this section of RE	loes not apply to the	in integet containers or in
transportatio	n ninelines sealed	in mact containers of in
BD vapors o	r liquid Where pro	oducts or processes containing BD
are exempte	d under paragraph	(a)(2) of this section, the employer
shall maintai	n records of the ob	pjective data supporting that
exemption a	nd the basis for the	e employer's reliance on the data, as
provided in p	paragraph (m)(1) o	f this section
1,3-Butadien	e means an organ	ic compound with chemical formula
54 15 g/mole		noiecular weight of approximately
OSHA speci	, fically regulated ca	rcinogen
STEL	5.000000 ppm	OSHA Specifically Regulated
		Chemicals/Carcinogens
1910.1051		
This section	applies to all occu	pational exposures to 1,3-Butadiene
(BD), Chemi	cal Abstracts Serv	the continue of the second s
provided in p	varagraph (a)(2) of	unis section. Except for the
section does	not apply to the p	rocessing use or handling of
products cor	taining BD or to of	her work operations and streams in
which BD is	present where obi	ective data are reasonably relied upon
that demons	trate the work ope	ration or the product or the group of
products or o	operations to which	n it belongs may not reasonably be
foreseen to r	elease BD in airbo	orne concentrations at or above the

action level or in excess of the STEL under the expected conditions of processing, use, or handling that will cause the greatest possible release or in any plausible accident. This section also does not apply to work operations, products or streams where the only exposure to BD is from liquid mixtures containing 0.1% or less of BD by volume or the vapors released from such liquids, unless objective data become available that show that airborne concentrations generated by such mixtures can exceed the action level or STEL under reasonably predictable conditions of processing, use or handling that will cause the greatest possible release. Except for labeling requirements and requirements for emergency response, this section does not apply to the storage, transportation, distribution or sale of BD or liquid mixtures in intact containers or in transportation pipelines sealed in such a manner as to fully contain BD vapors or liquid. Where products or processes containing BD are exempted under paragraph (a)(2) of this section, the employer shall maintain records of the objective data supporting that
BD vapors or liquid. Where products or processes containing BD are exempted under paragraph $(a)(2)$ of this section, the employer shall maintain records of the objective data supporting that
provided in paragraph (m)(1) of this section
1,3-Butadiene means an organic compound with chemical formula CH2=CH-CH=CH2 that has a molecular weight of approximately
54.15 g/mole

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
1,3-Butadiene	106-99-0	1,2 Dihydroxy-4- (N- acetylcystein yl)-butane	2.5000 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As	s soon as po	ssible after exposure	e ceases)
		Mixture of N- 1 and N- 2(hydroxybut enyl)valine	2.5pmol/g	Hemoglobin (Hb) adducts in blood	ACGIH - Biological Exposure Indices (BEI)
		Not critical			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Liquefied gas
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -109 °C (-164 °F) - lit.
f)	Initial boiling point and boiling range	-4.5 °C (23.9 °F) - lit.
g)	Flash point	-75.99 °C (-104.78 °F) - closed cup - Tested according to Annex V of Directive 67/548/EEC.
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 16.3 %(V) Lower explosion limit: 1.4 %(V)
k)	Vapour pressure	ca.2,400 hPa (1,800 mmHg) at 20 °C (68 °F) 3,200 hPa (2,400 mmHg) at 30 °C (86 °F) 5,700 hPa (4,275 mmHg) at 50 °C (122 °F)
I)	Vapour density	No data available
m)	Relative density	0.62 g/cm3 at 20 °C (68 °F)
n)	Water solubility	0.5 g/l at 20 °C (68 °F) - Tested according to Annex V of Directive 67/548/EEC.
o)	Partition coefficient: n- octanol/water	log Pow: 1.85 at 23 °C (73 °F)
p)	Auto-ignition temperature	No data available

- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available

9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Test for peroxide formation before using or discard after 3 months. Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5** Incompatible materials Oxidizing agents, Oxygen, Copper, Copper alloys, Carbides, Halogens, Metal oxides, Metals

10.6 Hazardous decomposition products

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 5,480 mg/kg

LC50 Inhalation - Rat - 4 h - 285 mg/l

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity In vivo tests showed mutagenic effects

Carcinogenicity

Carcinogenicity - Rat - Inhalation Tumorigenic:Carcinogenic by RTECS criteria. Cardiac:Tumors. Lungs, Thorax, or Respiration:Tumors.

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (1,3-Butadiene)

NTP: Known to be human carcinogen (1,3-Butadiene)

OSHA: OSHA specifically regulated carcinogen (1,3-Butadiene)

Reproductive toxicity

No data available

Reproductive toxicity - Mouse - Inhalation

Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Embryo or Fetus: Extra embryonic structures (e.g., placenta, umbilical cord). Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

No data available

Developmental Toxicity - Rat - Inhalation Specific Developmental Abnormalities: Musculoskeletal system.

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard No data available

Additional Information

RTECS: Not available

Cholinesterase inhibitors can cause heavy salivation and secretion in the lungs, lachrymation, blurred vision, involuntary defecation, diarrhea, tremor, ataxia, sweating, hypothermia, lowered heart rate, and/or a fall in blood pressure as a result of their action at cholinergic nerve sites., narcosis, Headache, Nausea, Vomiting, Dizziness, Drowsiness, Confusion., Weakness, Muscle cramps/spasms., Change in pupil size., Tremors, Seizures., Incoordination., Convulsions, Coma

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - other fish - 71.5 mg/l - 24 h

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available

12.4 Mobility in soil No data available

NO data avallable

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1010 Class: 2.1 Proper shipping name: Butadienes, stabilized Reportable Quantity (RQ): 10 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 1010 Class: 2.1 Proper shipping name: BUTADIENES, STABILIZED

ΙΑΤΑ

UN number: 1010 Class: 2.1 Proper shipping name: Butadienes, stabilized IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

EMS-No: F-D, S-U

SARA 313 Components

The following components are subject to reporting	levels established by SARA Title III,	Section 313:
		Devision Dete

	CAS-No.	Revision Date
1,3-Butadiene	106-99-0	1993-04-24
SARA 311/312 Hazards Fire Hazard, Sudden Release of Pressure Hazard, Chronic Hea	Ith Hazard	
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
1,3-Butadiene	106-99-0	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
1,3-Butadiene	106-99-0	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
1,3-Butadiene	106-99-0	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. 1,3-Butadiene	106-99-0	2007-09-28
WARNING: This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause birth defects or other reproductive harm.	106-99-0	2007-09-28
1.3-Butadiene		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
Flam. Gas	Flammable gases
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
------------	---
H340	May cause genetic defects.
H350	May cause cancer.
Muta.	Germ cell mutagenicity
Press. Gas	Gases under pressure

0

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	3
NFPA Rating	
Health hazard:	0
Fire Hazard:	4

Fire Hazard: Reactivity Hazard:

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.6

Revision Date: 03/03/2015

Print Date: 03/03/2016

SIGMA-ALDRICH

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SAFETY DATA SHEET

Version 4.4 Revision Date 04/24/2015 Print Date 01/29/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	1,4-Dichlorobenzene		
	Product Number Brand Index-No.	: : :	D56829 Aldrich 602-035-00-2		
	CAS-No.	:	106-46-7		
1.2	Relevant identified uses of	Relevant identified uses of the substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the	ne s	safety data sheet		
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		
1.4	Emergency telephone num	ıbe	r		

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Warning

Hazard statement(s) H319 H351 H410	Causes serious eye irritation. Suspected of causing cancer. Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P264	Wash skin thoroughly after handling.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.

P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₆ H ₄ Cl ₂
Molecular weight	:	147.00 g/mol
CAS-No.	:	106-46-7
EC-No.	:	203-400-5
Index-No.	:	602-035-00-2

Hazardous components

Component	Classification	Concentration
1,4-Dichlorobenzene		
	Eye Irrit. 2A; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1; H319, H351, H410	<= 100 %
For the full tout of the LL Otetements mentioned in this Cestion, and Cestion 40		

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

Further information

No data available

5.4

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis	
			parameters		
1,4-Dichlorobenzene	106-46-7	TWA	10.000000 ppm	USA. ACGIH Threshold Limit Values	
				(TLV)	
	Remarks	Eye irritation			
		Kidney damage			
		Confirmed animal carcinogen with unknown relevance to humans			
		Potential Occupational Carcinogen			
		See Append	ix A	-	
		TWA	75.000000 ppm	USA. Occupational Exposure Limits	
			450.000000	(OSHA) - Table Z-1 Limits for Air	
			mg/m3	Contaminants	
		The value in mg/m3 is approximate.			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: sheets Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 52 - 54 °C (126 - 129 °F) - lit
f)	Initial boiling point and boiling range	173 °C (343 °F) - lit.
g)	Flash point	66.0 °C (150.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	8.8 hPa (6.6 mmHg) at 50.0 °C (122.0 °F) 0.5 hPa (0.4 mmHg) at 25.0 °C (77.0 °F)
I)	Vapour density	No data available
m)	Relative density	1.241 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available

o)	Partition coefficient: n- octanol/water	log Pow: 3.40		
p)	Auto-ignition temperature	No data available		
q)	Decomposition temperature	No data available		
r)	Viscosity	No data available		
s)	Explosive properties	No data available		
t)	Oxidizing properties	No data available		
Other safety information				
	Bulk density	650 kg/m3		

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD0 Oral - Rat - male and female - > 2,000 mg/kg (OECD Test Guideline 401)

LC50 Inhalation - Rat - male and female - 4 h - > 5.07 mg/l

LD0 Dermal - Rat - > 2,000 mg/kg (OECD Test Guideline 402)

No data available

Skin corrosion/irritation

Skin - Rabbit Result: No skin irritation (OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit Result: No eye irritation (OECD Test Guideline 405)

Respiratory or skin sensitisation

Maximisation Test (GPMT) - Guinea pig Did not cause sensitisation on laboratory animals. (OECD Test Guideline 406)

Germ cell mutagenicity

No data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (1,4-Dichlorobenzene)

- NTP: Reasonably anticipated to be a human carcinogen (1,4-Dichlorobenzene)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: CZ4550000

Produces:, methemoglobin, Nausea, Vomiting, Increased pulse rate, Headache, Impairment of vision

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	flow-through test LC50 - Salmo gairdneri - 1.12 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	static test EC50 - Daphnia magna (Water flea) - 0.7 mg/l - 48 h
Toxicity to algae	Growth inhibition EC50 - Scenedesmus capricornutum (fresh water algae) - 1.6 mg/l $$ - 96 h

12.2 Persistence and degradability

Biodegradability aerobic - Exposure time 28 d Result: 30 % - Not rapidly biodegradable (OECD Test Guideline 301C)

12.3 Bioaccumulative potential Jordanella floridae - 5 d Bioaccumulation - 2.68 μg/l

Bioconcentration factor (BCF): 296

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (1,4-Dichlorobenzene) Reportable Quantity (RQ): 100 lbs Marine pollutant:yes Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (1,4-Dichlorobenzene) Marine pollutant:yes ΙΑΤΑ UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (1,4-Dichlorobenzene)

106-46-7

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting	levels established by SARA Title III,	Section 313:
	CAS-No.	Revision Date

1,4-Dichlorobenzene SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
1,4-Dichlorobenzene	106-46-7	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
1,4-Dichlorobenzene	106-46-7	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
1,4-Dichlorobenzene	106-46-7	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	106-46-7	2007-09-28
1 1 Dichlarabanzana		

1.4-Dichlorobenzene

Revision Date

2007-07-01

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H319	Causes serious eye irritation.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	2
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.4

Revision Date: 04/24/2015

Print Date: 01/29/2016

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.4 Revision Date 03/03/2015 Print Date 04/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers		
	Product name	:	1,4-Dioxane
	Product Number	:	296309
	Brand	:	Sigma-Aldrich
	Index-No.	:	603-024-00-5
	CAS-No.	:	123-91-1
1.2	Relevant identified uses of	of th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Manufacture of substances
1.3	Details of the supplier of	the	safety data sheet
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052
1.4	Emergency telephone nu	mbe	r

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.

P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ eye protection/ face protection.
P281	Use personal protective equipment as required.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

May form explosive peroxides., Repeated exposure may cause skin dryness or cracking. May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

:	Dioxane Diethylene oxide
:	С ₄ Н ₈ О ₂
:	88.11 g/mol
:	123-91-1
:	204-661-8
:	603-024-00-5
:	01-2119462837-26-XXXX
	:

Hazardous components

Component	Classification	Concentration
1,4-Dioxane		
	Flam. Liq. 2; Eye Irrit. 2A; Carc. 2; STOT SE 3; H225, H319, H335, H351	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis	
1,4-Dioxane	123-91-1	TWA	20.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)	
	Remarks	Liver damag Confirmed a	e nimal carcinogen v	vith unknown relevance to humans	
		Danger of cu	itaneous absorptio	n	
		TWA	20 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		Liver damage Confirmed animal carcinogen with unknown relevance to humans			
		TWA	25 ppm 90 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000	
		Skin notation			
		TWA	100.000000 ppm 360.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		Skin designation		•	
		The value in	mg/m3 is approxir	nate.	
		TWA	100 ppm 360 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		Skin designa	ation	·	
		The value in mg/m3 is approximate.			
		С	1.000000 ppm 3.600000 mg/m3	USA. NIOSH Recommended Exposure Limits	
		Potential Oc See Append 30 minute ce	cupational Carcino ix A eiling value	gen	

Derived No Effect Level (DNEL)

Application Area	Exposure routes	Health effect	Value
Workers	Inhalation	Long-term local effects	144 mg/m3
Workers	Inhalation	Long-term systemic effects	73 mg/m3
Workers	Skin contact	Long-term systemic effects	21 mg/m3

Predicted No Effect Concentration (PNEC)

Compartment	Value
Soil	0.153 mg/kg
Marine water	0.67 mg/l
Fresh water	10 mg/l
Fresh water sediment	37 mg/kg
Sewage treatment plant	2700 mg/l
Aquatic intermittent release	10 mg/l

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: butyl-rubber Minimum layer thickness: 0.3 mm Break through time: 480 min Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact Material: Chloroprene Minimum layer thickness: 0.6 mm Break through time: 35 min Material tested:Camapren® (KCL 722 / Aldrich Z677493, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

;	a)	Appearance	Form: liquid Colour: colourless
	b)	Odour	No data available
	c)	Odour Threshold	No data available
	d)	рН	6.0 - 8 at 500 g/l at 20 °C (68 °F)
	e)	Melting point/freezing point	Melting point/range: 10 - 12 °C (50 - 54 °F) - lit.
t	f)	Initial boiling point and boiling range	100 - 102 °C (212 - 216 °F) - lit.
1	g)	Flash point	12 °C (54 °F) - closed cup
	h)	Evaporation rate	No data available
	i)	Flammability (solid, gas)	No data available
j	j)	Upper/lower flammability or explosive limits	Upper explosion limit: 22 %(V) Lower explosion limit: 2 %(V)
	k)	Vapour pressure	36 hPa (27 mmHg) at 20 °C (68 °F) 53 hPa (40 mmHg) at 25.20 °C (77.36 °F)
0.	l)	Vapour density	3.04 - (Air = 1.0)
Sigma-A	aricr	1 - 290309	

10.1	Reactivity				
10. S	10. STABILITY AND REACTIVITY				
		Relative vapour density	3.04 - (Air = 1.0)		
		Surface tension	36.9 mN/m at 25 °C (77 °F)		
9.2 Other safety information					
	t)	Oxidizing properties	No data available		
	s)	Explosive properties	No data available		
	r)	Viscosity	No data available		
	q)	Decomposition temperature	No data available		
	p)	Auto-ignition temperature	300 °C (572 °F)		
	o)	Partition coefficient: n- octanol/water	log Pow: -0.27		
	n)	Water solubility	completely miscible		
	m)	Relative density	1.034 g/cm3 at 25 °C (77 °F)		

10.

10.

No data available

10.2 Chemical stability

Stable under recommended storage conditions. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year. Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Vapours may form explosive mixture with air. Vapours may form explosive mixture with air.

- 10.4 Conditions to avoid Heat, flames and sparks.
- Incompatible materials 10.5 Oxygen, Oxidizing agents, Halogens, Reducing agents, Perchlorates., Trimethylaluminum

Hazardous decomposition products 10.6

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 4,200 mg/kg

LC50 Inhalation - Rat - 2 h - 46,000 mg/m3 Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Other.

LD50 Dermal - Rabbit - 7,858 mg/kg

No data available

Skin corrosion/irritation

Skin - Human Remarks: Chronic exposure causes drying effect on the skin and eczema.

Skin - Rabbit Result: No skin irritation

Serious eye damage/eye irritation Eyes - Rabbit Result: Eye irritation - 24 h

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (1,4-Dioxane)

NTP: Reasonably anticipated to be a human carcinogen (1,4-Dioxane)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure May cause respiratory irritation.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information

RTECS: JG8225000

Nausea, Vomiting, Weakness, Dizziness, Vertigo, Headache, Sweating, loss of appetite, Kidney injury may occur. Liver injury may occur.

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Liver - Irregularities - Based on Human Evidence Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 985 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 8,450 mg/l - 24 h
Toxicity to algae	EC50 - Desmodesmus subspicatus (green algae) - > 500 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability Result: < 5 % - Not readily biodegradable.

12.3 Bioaccumulative potential Does not bioaccumulate.

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1165 Class: 3 Proper shipping name: Dioxane Reportable Quantity (RQ): 100 lbs	Packing group: II		
Poison Inhalation Hazard: No			
IMDG UN number: 1165 Class: 3 Proper shipping name: DIOXANE	Packing group: II	EMS-No: F-E, S-D	
IATA UN number: 1165 Class: 3 Proper shipping name: Dioxane	Packing group: II		

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels e	stablished by SARA Title II	I, Section 313:
	CAS-No	Revision Date

	070-110.	Revision Date
1,4-Dioxane	123-91-1	2007-07-01
SARA 311/312 Hazards Fire Hazard, Acute Health Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
.	CAS-No.	Revision Date
1,4-Dioxane	123-91-1	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
1,4-Dioxane	123-91-1	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
1,4-Dioxane	123-91-1	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	123-91-1	2007-09-28
1,4-Dioxane		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
STOT SE	Specific target organ toxicity - single exposure

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.4

Revision Date: 03/03/2015

Print Date: 04/11/2016



SAFETY DATA SHEET

Creation Date 22-Sep-2009

Revision Date 18-Dec-2019

Revision Number 4

	1. Identification				
Product Name	1,4-Diethylbenzene				
Cat No. : AC114150000; AC114150050; AC114150250					
CAS-No Synonyms	105-05-5 No information available				
Recommended Use Laboratory chemicals. Jses advised against Food, drug, pesticide or biocidal product use. Details of the supplier of the safety data sheet Example of the safety data sheet					
CompanyFisher ScientificAcros OrganicsOne Reagent LaneOne Reagent LaneFair Lawn, NJ 07410Fair Lawn, NJ 07410Fel: (201) 796-7100Fair Lawn, NJ 07410					
Emergency Telephone Numb For information US call: 001-80	ber 00-ACROS-01 / Europe call: +32 14 57 52 11				

Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99 **CHEMTREC** Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 3
Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Aspiration Toxicity	Category 1

Label Elements

Signal Word Danger

Hazard Statements

Flammable liquid and vapor May be fatal if swallowed and enters airways Causes skin irritation Causes serious eye irritation



Precautionary Statements Prevention

Wash face, hands and any exposed skin thoroughly after handling Wear protective gloves/protective clothing/eye protection/face protection Keep away from heat/sparks/open flames/hot surfaces. - No smoking Keep container tightly closed Ground/bond container and receiving equipment Use explosion-proof electrical/ventilating/lighting/equipment Use only non-sparking tools Take precautionary measures against static discharge Skin If skin irritation occurs: Get medical advice/attention IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower Wash contaminated clothing before reuse Eves IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention Ingestion IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician Do NOT induce vomiting Fire In case of fire: Use CO2, dry chemical, or foam for extinction Storage Store locked up Store in a well-ventilated place. Keep cool Disposal Dispose of contents/container to an approved waste disposal plant Hazards not otherwise classified (HNOC) Toxic to aquatic life

Toxic to aquatic life with long lasting effects

3. Composition/Information on Ingredients

Component p-Diethyl benzene		CAS-No	Weight %	
		105-05-5	98	
	4	. First-aid measures		
General Advice	If symptom	s persist, call a physician.		
Eye Contact	Rinse imme medical att	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.		
Skin Contact	Wash off in call a physi	Wash off immediately with plenty of water for at least 15 minutes. If skin irritation persists, call a physician.		
Inhalation	Remove to symptoms	fresh air. If not breathing, give artificial occur. Risk of serious damage to the lur	respiration. Get medical attention if ngs (by aspiration).	

Most important symptoms and	a physician or poison control center immediately. If vomiting occurs naturally, have victim lean forward.				
effects	tiredness, nausea and vomiting				
Notes to Physician	Treat symptomatically				

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO 2). Dry chemical. Chemical foam. Water mist may be used to cool closed containers.
Unsuitable Extinguishing Media	No information available
Flash Point	56 °C / 132.8 °F
Method -	CC (closed cup)
Autoignition Temperature	430 °C / 806 °F
Explosion Limits Upper Lower Sensitivity to Mechanical Impact	.00% .80% No information available

Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Combustible material. Flammable. Containers may explode when heated. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back.

Hazardous Combustion Products

Carbon monoxide (CO). Carbon dioxide (CO₂).

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA_	Flowmobility	Instability	Dhusiaal haranda					
3	2 2	0	N/A					
	6. Accidental re	elease measures						
Personal Precautions	Use personal protective of sources of ignition. Take	equipment as required. Ensure a precautionary measures against	dequate ventilation. Remove all t static discharges.					
Environmental Precautions	Do not flush into surface	Do not flush into surface water or sanitary sewer system.						
Methods for Containment and Cle Up	ean Keep in suitable, closed Remove all sources of ig	containers for disposal. Soak up nition. Use spark-proof tools and	with inert absorbent material. I explosion-proof equipment.					
	7. Handling	and storage						
Handling	Wear personal protective get in eyes, on skin, or or flames, hot surfaces and precautionary measures	e equipment/face protection. Ens n clothing. Avoid ingestion and ir sources of ignition. Use only no against static discharges.	ure adequate ventilation. Do not halation. Keep away from open n-sparking tools. Take					
Storage	Keep in a dry, cool and w label for specific storage away from heat, sparks a	vell-ventilated place. Refer produ temperature requirement. Keep and flame. Keep container tightly	ict specification and/or product container tightly closed. Keep closed in a dry and well-ventilated					

place.					
8. E>	posure controls / personal protection				
Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.				
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting/equipment. Ensure that eyewash stations and safety showers are close to the workstation location.				
Personal Protective Equipment					
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.				
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.				
Respiratory Protection	No protective equipment is needed under normal use conditions.				
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.				

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	Strong
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-43 °C / -45.4 °F
Boiling Point/Range	184 °C / 363.2 °F @ 760 mmHg
Flash Point	56 °C / 132.8 °F
Method -	CC (closed cup)
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	.00%
Lower	.80%
Vapor Pressure	140.52 Pa @ 25 °C
Vapor Density	4.64
Specific Gravity	0.862
Solubility	slightly soluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	430 °C / 806 °F
Decomposition Temperature	No information available
Viscosity	3.6 mPas @ 20°C
Molecular Formula	C10 H14
Molecular Weight	134.22
Refractive index	1.495

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Exposure

		to light. Incompatible products.						
Incompatible Materials		Strong oxidizing agents						
Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO2)								
Hazardous Polymerization		lazardous polymerization does not occur.						
Hazardous Reactions		None under norma	one under normal processing.					
		11. Toxico	ological in	formation				
Acute Toxicity								
Product Information Component Information		Product does not p	present an acute	toxicity hazard base	d on known or sup	plied information		
Component		LD50 Oral		LD50 Dermal	LC50	Inhalation		
p-Diethyl benzene		OECD 401 (Rat) > 2000 mg/kg		Not listed	OECD > 50	0 403 (Rat) 00 mg/m ³		
Toxicologically Synergistic		No information ava	ailable					
Delayed and immediate effect	cts as w	ell as chronic effe	cts from short a	and long-term expo	sure			
Irritation		Irritating to eyes and skin						
Sensitization		No information ava	ilable					
Carcinogenicity		The table below inc	dicates whether	each agency has list	ed any ingredient	as a carcinogen.		
Component CAS	-No	IARC	NTP	ACGIH	OSHA	Mexico		
p-Diethyl benzene 105-	05-5	Not listed	Not listed	Not listed	Not listed	Not listed		
Mutagenic Effects		No information ava	ailable					
Reproductive Effects	No information available.							
Developmental Effects		No information available.						
Teratogenicity		No information available.						
STOT - single exposure STOT - repeated exposure		None known None known						
Aspiration hazard		Category 1						
Symptoms / effects,both ac delayed	ute and	Symptoms of overe	exposure may be	e headache, dizzines	s, tiredness, naus	ea and vomiting		
Endocrine Disruptor Informa	tion	No information ava	ilable					
Other Adverse Effects		The toxicological p	roperties have n	ot been fully investig	ated.			

12. Ecological information

Ecotoxicity Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
p-Diethyl benzene	Pseudokirchnerella Subcapitata EC50 = 1.9 mg/L, 72 hr	Oryzias Latipes LC50 = 1.8 mg/L, 96h	EC50 = 250 mg/L	Daphnia Magna LC50 = 32 mg/L, 24 hr
	1 1114 NA 1 1 1	1 1 1 1 1 1	11	

Persistence and Degradability

May persist based on information available.

Bioaccumulation/Accumulation

No information available.

Mobility

Is not likely mobile in the environment due its low water solubility.

Component	log Pow
p-Diethyl benzene	4.06 @ 25 °C

Use Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT	
UN-No	UN2049
Proper Shipping Name	DIETHYLBENZENE
Hazard Class	3
Packing Group	III
TDG	
UN-No	UN2049
Proper Shipping Name	DIETHYLBENZENE
Hazard Class	3
Packing Group	III
IATA	
UN-No	UN2049
Proper Shipping Name	DIETHYLBENZENE
Hazard Class	3
Packing Group	III
IMDG/IMO	
UN-No	UN2049
Proper Shipping Name	DIETHYLBENZENE
Hazard Class	3
Packing Group	III
	15 Regulatory information
	is regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
p-Diethyl benzene	105-05-5	Х	ACTIVE	-

Legend:

TSCA - Toxic Substances Control Act, (40 CFR Part 710) X - Listed '-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories

Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
p-Diethyl benzene	105-05-5	-	Х	203-265-2	Х	Х	-	Х	KE-10437

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories	See section 2 for more information
CWA (Clean Water Act)	Not applicable
Clean Air Act	Not applicable
OSHA - Occupational Safety and Health Administration	Not applicable
CERCLA	Not applicable
California Proposition 65	This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

togulations					
Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
p-Diethyl benzene	Х	-	Х	-	-

U.S. Department of Transportation	
Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν
U.S. Department of Homeland Security	This product does not contain any DHS chemicals.
Other International Regulations	
Mexico - Grade	No information available

16. Other information

Prepared By

Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

 Creation Date
 22-Sep-2009

 Revision Date
 18-Dec-2019

 Print Date
 18-Dec-2019

 Revision Summary
 SDS sections updated. 2. 3. 4. 6. 7. 8. 9. 10. 11. 12. 16.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

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SAFETY DATA SHEET

Version 5.4 Revision Date 11/03/2015 Print Date 04/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	2,2,4-Trimethylpentane
	Product Number Brand Index-No.	:	360597 Sigma-Aldrich 601-009-00-8
	CAS-No.	:	540-84-1
1.2	Relevant identified use	s of th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Skin irritation (Category 2), H315 Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336 Aspiration hazard (Category 1), H304 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H410	Very toxic to aquatic life with long lasting effects.

Precautionary statement(s) P210

Keep away from heat/sparks/open flames/hot surfaces. No smoking.

P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
	protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/
	physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated
	clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position
	comfortable for breathing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P321	Specific treatment (see supplemental first aid instructions on this label).
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for
	extinction.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances Synonyms

Isooctano
ISUUCIAILE

Formula	:	C ₈ H ₁₈
Molecular weight	:	114.23 g/mol
CAS-No.	:	540-84-1
EC-No.	:	208-759-1
Index-No.	:	601-009-00-8
Registration number	:	01-2119457965-22-XXXX

Hazardous components

Component	Classification	Concentration
2,2,4-Trimethylpentane		
	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315 H336, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture

Carbon oxides

Nature of decomposition products not known.

Carbon oxides

Flash back possible over considerable distance., Container explosion may occur under fire conditions.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
2,2,4- Trimethylpentane	540-84-1	TWA	300.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Upper Respir	ratory Tract irritatio	n

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 482 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 90 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1	Information on basic physical and chemical properties		
	a)	Appearance	Form: liquid
	b)	Odour	No data available
	c)	Odour Threshold	No data available
	d)	рН	No data available
	e)	Melting point/freezing point	Melting point/range: -107 °C (-161 °F)
	f)	Initial boiling point and boiling range	98 - 99 °C (208 - 210 °F)
	g)	Flash point	-12 °C (10 °F) - closed cup
	h)	Evaporation rate	No data available
	i)	Flammability (solid, gas)	No data available
	j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6 %(V) Lower explosion limit: 1 %(V)
	k)	Vapour pressure	55 hPa (41 mmHg) at 21 °C (70 °F) 117 hPa (88 mmHg) at 37.80 °C (100.04 °F)
	I)	Vapour density	3.94 - (Air = 1.0)
	m)	Relative density	0.692 g/mL at 25 °C (77 °F)
	n)	Water solubility	insoluble
	o)	Partition coefficient: n- octanol/water	log Pow: 4.6
	p)	Auto-ignition temperature	No data available
	q)	Decomposition temperature	No data available
	r)	Viscosity	No data available
	s)	Explosive properties	No data available
	t)	Oxidizing properties	No data available
9.2	Oth	er safety information	
		Relative vapour density	3.94 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1	Reactivity	
	N N N N N N N N N N	

No data available

10.2 Chemical stability Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Vapours may form explosive mixture with air.

10.4 Conditions to avoid

Heat, flames and sparks. Extremes of temperature and direct sunlight.

- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - > 5,000 mg/kg (OECD Test Guideline 401)

LC50 Inhalation - Rat - 4 h - > 33.52 mg/l (OECD Test Guideline 403)

LD50 Dermal - Rabbit - > 2,000 mg/kg (OECD Test Guideline 402)

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Irritating to skin. (OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit Result: No eye irritation (OECD Test Guideline 405)

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

Rat Unscheduled DNA synthesis

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure

May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.

Additional Information

RTECS: SA3320000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Liver - Irregularities - Based on Human Evidence Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- **12.2 Persistence and degradability** No data available
- 12.3 Bioaccumulative potential
- **12.4 Mobility in soil** No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1262 Class Proper shipping name: Octa Reportable Quantity (RQ): 1 Marine pollutant:yes Poison Inhalation Hazard: N	es: 3 Packing grou nes 000 lbs o	p: II	
IMDG UN number: 1262 Clas Proper shipping name: OCT Marine pollutant:yes	s: 3 Packing grou	p: II EMS-No: F-E, S-E	<u>:</u>
IATA UN number: 1262 Clas Proper shipping name: Octa	es: 3 Packing grou	p: II	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

CAS-No.	Revision Date
540-84-1	2007-03-01
CAS-No.	Revision Date
540-84-1	2007-03-01
CAS-No.	Revision Date
540-84-1	2007-03-01
	CAS-No. 540-84-1 CAS-No. 540-84-1 CAS-No. 540-84-1

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	0
NFPA Rating	

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.4

Revision Date: 11/03/2015

Print Date: 04/01/2016

MATERIAL SAFETY DATA SHEET

Date Printed: 05/24/2004 Date Updated: 03/10/2004 Version 1.5

Section 1 - Product and Company Information Product Name 2-BUTANONE, 99.5+%, HPLC GRADE Product Number 270695 Brand ALDRICH Company Sigma-Aldrich Street Address 3050 Spruce Street SAINT LOUIS MO 63103 US City, State, Zip, Country Technical Phone: 314 771 5765 414 273 3850 Ext. 5996 Emergency Phone: 800 325 5052 Fax: Section 2 - Composition/Information on Ingredient Substance Name CAS # SARA 313 78-93-3 2-BUTANONE Yes Formula C4H8O Synonyms Acetone, methyl- * Aethylmethylketon (German) * Butanone * 2-Butanone (OSHA) * Butanone 2 (French) * 3-Butanone * Ethyl methyl cetone (French) * Ethylmethylketon (Dutch) * Ketone, ethyl methyl * Meetco * MEK (OSHA) * Methyl acetone * Methyl ethyl ketone (ACGIH:OSHA) * Metiletilchetone (Italian) * Metyloetyloketon (Polish) * RCRA waste number U159 RTECS Number: EL6475000 Section 3 - Hazards Identification EMERGENCY OVERVIEW Flammable (USA) Highly Flammable (EU). Irritant. Irritating to respiratory system and skin. Risk of serious damage to eyes. Vapors may cause drowsiness and dizziness. Target organ(s): Central nervous system. HMIS RATING HEALTH: 2* FLAMMABILITY: 3 REACTIVITY: 1 NFPA RATING HEALTH: 2 FLAMMABILITY: 3 **REACTIVITY:** 1 *additional chronic hazards present. For additional information on toxicity, please refer to Section 11. Section 4 - First Aid Measures

ORAL EXPOSURE If swallowed, wash out mouth with water provided person is conscious. Call a physician. INHALATION EXPOSURE If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. DERMAL EXPOSURE In case of contact, immediately wash skin with soap and copious amounts of water. EYE EXPOSURE In case of contact, immediately flush eyes with copious amounts of water for at least 15 minutes. Section 5 - Fire Fighting Measures FLAMMABLE HAZARDS Flammable Hazards: Yes EXPLOSION HAZARDS Vapor may travel considerable distance to source of ignition and flash back. Container explosion may occur under fire conditions. FLASH POINT 30 °F -1 °C Method: closed cup EXPLOSION LIMITS Lower: 1.8 % Upper: 10.1 % AUTOIGNITION TEMP 516 °C FLAMMABILITY N/A EXTINGUISHING MEDIA Suitable: Water spray. Carbon dioxide, dry chemical powder, or appropriate foam. FIREFIGHTING Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Flammable liquid. Emits toxic fumes under fire conditions. Section 6 - Accidental Release Measures PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL Evacuate area. Shut off all sources of ignition. Use nonsparking tools. PROCEDURE(S) OF PERSONAL PRECAUTION(S) Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. METHODS FOR CLEANING UP Cover with dry-lime, sand, or soda ash. Place in covered containers using non-sparking tools and transport outdoors. Ventilate area and wash spill site after material pickup is complete.

Section 7 - Handling and Storage

	-				
HANDLING User Expo skin, on	osure: Do not clothing. Ave	breat bid pi	the vapor rolonged o	. Do not get in eyes, on or repeated exposure.	
STORAGE Suitable: open flam	: Keep tightly Me. Store in a	y clos a cool	sed. Keep l dry plac	away from heat, sparks, and ce. Store under nitrogen.	
SPECIAL REQU Hygroscor	JIREMENTS Dic.				
Section 8 -	Exposure Cont	crols	/ PPE		
ENGINEERING Safety sh exhaust n	CONTROLS nower and eye required.	bath	. Use non:	sparking tools. Mechanical	
PERSONAL PRO Respirato Hand: Con Eye: Chen	DTECTIVE EQUID Dry: Governmen Mpatible chemen Mical safety g	PMENT nt app ical-1 goggle	proved represented represented to the provided set of the provided	spirator. gloves.	
GENERAL HYGI Remove ar after har	IENE MEASURES nd wash contar ndling.	minate	ed clothin	ng promptly. Wash thoroughly	
EXPOSURE LIN Country USA USA USA USA New Zealand	MITS, RTECS Source ACGIH ACGIH MSHA Standard OSHA. OEL	l-air	Type STEL TWA TWA PEL	Value 300 PPM 200 PPM 200 PPM (590 MG/M3) 8H TWA 200 PPM (590 MG/M3)	
Remarks: che USA	eck ACGIH TLV NIOSH		TWA STEL	200 PPM 300 PPM	
EXPOSURE LIN Country Poland Poland Poland	IITS Source		Type NDS NDSCh NDSP	Value 200 MG/M3 850 MG/M3 -	
Section 9 -	Physical/Cher	nical	Properti	es	
Appearance	I	Physic Color:	cal State : Colorle	: Clear liquid ss	
Property	۲	Value		At Temperature or Pressu	ıre
Molecular We pH BP/BP Range MP/MP Range Freezing Poi Vapor Pressu Vapor Densit Saturated Va SG/Density	eight Int Ire Cy Apor Conc. 1	72.11 V/A 79 - 8 -87 °C -85.9 71 mmH 2.49 C V/A 0.804	AMU 30°C °C Hg g/l g/cm3	20 °C	
Bulk Density	N/A				
-----------------------	----------------------	----------------------			
Odor Threshold	5.4 - 1 ppm				
Volatile%	N/A				
VOC Content	N/A				
Water Content	N/A				
Solvent Content	N/A				
Evaporation Rate	N/A				
Viscosity	0.4 Pas	25 °C			
Surface Tension	24.6 mN/m	20 °C			
Partition Coefficient	Log Kow: 0.29				
Decomposition Temp.	N/A				
Flash Point	30 °F -1 °C	Method: closed cup			
Explosion Limits	Lower: 1.8 %				
	Upper: 10.1 %				
Flammability	N/A				
Autoignition Temp	516 °C				
Refractive Index	1.379				
Optical Rotation	N/A				
Miscellaneous Data	N/A				
Solubility	Solubility in Water	:soluble			
-	Other Solvents: ALCO	OHOL, ETHER, ACETONE			
	BENZENE				

N/A = not available

Section 10 - Stability and Reactivity

STABILITY Stable: Stable. Conditions to Avoid: Protect from moisture. Materials to Avoid: Oxidizing agents, Strong reducing agents.

HAZARDOUS DECOMPOSITION PRODUCTS Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE

Skin Contact: Causes skin irritation. Skin Absorption: May be harmful if absorbed through the skin. Eye Contact: Causes severe eye irritation. Inhalation: Material is irritating to mucous membranes and upper respiratory tract. May be harmful if inhaled. Ingestion: May be harmful if swallowed.

TARGET ORGAN(S) OR SYSTEM(S) Central nervous system.

SIGNS AND SYMPTOMS OF EXPOSURE Can cause CNS depression. Exposure can cause: Gastrointestinal disturbances. Narcotic effect.

TOXICITY DATA

Oral Rat 2737 mg/kg LD50

Inhalation Rat 23,500 mg/m3 LC50 Intraperitoneal Rat 607 MG/KG LD50 Oral Mouse 4050 mg/kg LD50 Inhalation Mouse 32,000 mg/m3 LC50 Intraperitoneal Mouse 616 MG/KG LD50 Skin Rabbit 6480 mg/kg LD50 Inhalation Mammal 38,000 mg/m3 LC50 IRRITATION DATA Eyes Human 350 ppm Skin Rabbit 500 mg 24H Remarks: Moderate irritation effect Skin Rabbit 402 mg 24H Remarks: Mild irritation effect Skin Rabbit 13.78 mg 24H Remarks: Open irritation test Eyes Rabbit

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ALDRICH - 270695
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80 mg

CHRONIC EXPOSURE - TERATOGEN

Species: Rat Dose: 3000 PPM/7H Route of Application: Inhalation Exposure Time: (6-15D PREG) Result: Specific Developmental Abnormalities: Craniofacial (including nose and tongue). Specific Developmental Abnormalities: Urogenital system. Specific Developmental Abnormalities: Homeostasis

Species: Rat Dose: 1000 PPM/7H Route of Application: Inhalation Exposure Time: (6-15D PREG) Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). Specific Developmental Abnormalities: Musculoskeletal system.

Species: Mouse Dose: 3000 PPM/7H Route of Application: Inhalation Exposure Time: (6-15D PREG) Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus).

Section 12 - Ecological Information

ACUTE ECOTOXICITY TESTS

Test Type: EC50 Daphnia Species: Daphnia magna Time: 24 h Value: 7,060 mg/l

Test Type: LC50 Fish Species: Leuciscus idus Time: 48 h Value: 4,600 - 4,880 mg/l

Test Type: LC50 Fish Species: Pimephales promelas (Fathead minnow) Time: 96 h Value: 3,130 - 3,320 mg/l

Section 13 - Disposal Considerations

APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION Contact a licensed professional waste disposal service to dispose of this material. Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Observe all federal, state, and local environmental regulations.

Section 14 - Transport Information

DOT

```
Proper Shipping Name: Ethyl methyl ketone [or] Methyl
ethyl ketone
UN#: 1193
Class: 3
```

Packing Group: Packing Group II Hazard Label: Flammable liquid PIH: Not PIH IATA Proper Shipping Name: Methyl ethyl ketone IATA UN Number: 1193 Hazard Class: 3 Packing Group: II Section 15 - Regulatory Information EU DIRECTIVES CLASSIFICATION Symbol of Danger: F Xi Indication of Danger: Highly Flammable. Irritant. R: 11 36 66 67 Risk Statements: Highly flammable. Irritating to eyes. Repeated exposure may cause skin dryness or cracking. Vapors may cause drowsiness and dizziness. S: 9 16 Safety Statements: Keep container in a well-ventilated place. Keep away from sources of ignition - no smoking. US CLASSIFICATION AND LABEL TEXT Indication of Danger: Flammable (USA) Highly Flammable (EU). Irritant. Risk Statements: Irritating to respiratory system and skin. Risk of serious damage to eyes. Vapors may cause drowsiness and dizziness. Safety Statements: Keep away from sources of ignition - no smoking. Take precautionary measures against static discharges. In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear eye/face protection. US Statements: Target organ(s): Central nervous system. UNITED STATES REGULATORY INFORMATION SARA LISTED: Yes DEMINIMIS: 1 % NOTES: This product is subject to SARA section 313 reporting requirements. TSCA INVENTORY ITEM: Yes CANADA REGULATORY INFORMATION WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS contains all the information required by the CPR. DSL: Yes NDSL: No Section 16 - Other Information DISCLAIMER For R&D use only. Not for drug, household or other uses. WARRANTY The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The

purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2004 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only.



Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Revision Date 10-Feb-2015

Revision Number 1

	1. Identification	1
Product Name	2-Methylnaphthalene, 99% (go	:)
Cat No. :	AC414551000; AC414555000	
Synonyms	No information available	
Recommended Use	Laboratory chemicals.	
Uses advised against Details of the supplier of the	No Information available safety data sheet	
Company Fisher Scientific One Reagent Lane	Entity / Business Name Acros Organics One Reagent Lane	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11

Fair Lawn, NJ 07410 Tel: (201) 796-7100

Fair Lawn, NJ 07410

Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity
Skin Corrosion/irritation
Serious Eye Damage/Eye Irritation
Specific target organ toxicity (single exposure)
Target Organs - Respiratory system.

Category 4 Category 2 Category 2 Category 3

Label Elements

Signal Word Warning

Hazard Statements

Harmful if swallowed Causes skin irritation Causes serious eye irritation May cause respiratory irritation



Precautionary Statements

Prevention

Wash face, hands and any exposed skin thoroughly after handling Do not eat, drink or smoke when using this product Wear protective gloves/protective clothing/eye protection/face protection

Avoid breathing dust/fume/gas/mist/vapors/spray

Use only outdoors or in a well-ventilated area

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor/physician if you feel unwell

Skin

IF ON SKIN: Wash with plenty of soap and water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention

Ingestion

IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell

Rinse mouth

Storage

Store in a well-ventilated place. Keep container tightly closed Store locked up

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component CAS-No Weight			Weight %
2-Methylnaphthalene 91-57-6			99.0
	4.	First-aid measures	
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.		
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes.		
Inhalation	Move to fresh air.		
Ingestion	Do not induce vomiting.		
Most important symptoms/effects Notes to Physician	No information available. Treat symptomatically		
	5. Fi	re-fighting measures	
Unsuitable Extinguishing Media	No information available		

Flash Point	
Method -	No information available
Autoignition Temperature	No information available
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

None known

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health 2	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental re	lease measures	
Personal Precautions Environmental Precautions	Ensure adequate ventilation. Use personal protective equipment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.		

Methods for Containment and Clean No information available. Up

7. Handling and storage

Handling

Ensure adequate ventilation.

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
2-Methylnaphthalene	TWA: 0.5 ppm		
	Skin		

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
2-Methylnaphthalene			TWA: 0.5 ppm Skin

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

Engineering Measures	Ensure adequate ventilation, especially in confined areas.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Hygiene Measures	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced. Handle in accordance with good industrial hygiene and safety practice.		
9	. Physical and chemical properties		
Physical State Appearance Odor Odor Threshold pH Melting Point/Range Boiling Point/Range Flash Point Evaporation Rate Flammability (solid,gas) Flammability or explosive limits Upper Lower Vapor Pressure Vapor Pressure Vapor Density Relative Density Solubility Partition coefficient; n-octanol/wate Autoignition Temperature Decomposition Temperature	Solid No information available Odorless No information available 37 38 °C °C No information available No data available No data available No data available < 1 mmHg @ 25 °C No information available 1.0000 Insoluble in water No data available No data available No information available		
Molecular Formula Molecular Weight	C11H10 142.20		
10. Stability and reactivity			

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products.
Incompatible Materials	Strong oxidizing agents
Hazardous Decomposition Products None under normal use conditions	
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
2-Methylnaphthalene	1630 mg/kg (Rat)	Not listed	Not listed
Toxicologically Synergistic	No information available		
Products			
Delayed and immediate effects as well as chronic effects from short and long-term exposure_			
Irritation	No information available		

Sensitization

No information available

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico			
2-Methylnaphthalene	91-57-6	Not listed	Not listed	Not listed	Not listed	Not listed			
Mutagenic Effects		No information ava	ailable						
Reproductive Effects		No information available.							
Developmental Effe	cts	No information ava	ailable.						
Teratogenicity		No information available.							
STOT - single exposure STOT - repeated exposure		Respiratory system None known							
Aspiration hazard		No information available							
Symptoms / effects,both acute and delayed		No information available							
Endocrine Disruptor Information		No information available							
Other Adverse Effect	sts	The toxicological p	properties have not	t been fully investig	ated.				

12. Ecological information

Ecotoxicity

Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
2-Methylnaphthalene Not listed		Pimephales promelas:LC50	Not listed	EC50 = 1.5 mg/L/48h
		= 2.5mg/L		
Persistence and Degrada	bility No information	on available		
Bioaccumulation/ Accum	ulation No information	on available.		

Mobility

No information available.

Component	log Pow
2-Methylnaphthalene	3.86

13. Disposal considerations

 Waste Disposal Methods
 Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

	14. Transport information
DOT	Not regulated
TDG	Not regulated
ΙΑΤΑ	Not regulated
IMDG/IMO	Not regulated
	15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
2-Methylnaphthalene	Х	Х	-	202-078-3	-		Х	Х	Х	Х	-
Lagand											

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable	
SARA 313	Not applicable	
SARA 311/312 Hazardous Acute Health Hazard Chronic Health Hazar Fire Hazard Sudden Release of Pr Reactive Hazard	s Categorization d ressure Hazard	Yes No No No No
Clean Water Act	Not applicable	

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

Not applicable

California Proposition 65

This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
2-Methylnaphthalene	-	Х	-	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D1B Toxic materials



The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.



SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.1 Revision Date 06/26/2014 Print Date 05/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	4,4'-DDD
	Product Number Brand	:	35486 Sigma-Aldrich
	CAS-No.	:	72-54-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Acute toxicity, Dermal (Category 4), H312 Carcinogenicity (Category 2), H351 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.

P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P322	Specific measures (see supplemental first aid instructions on this label).
P330	Rinse mouth.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	1,1-Dichloro-2,2-bis(4-chlorophenyl)ethane TDE

Formula	: C ₁₄ H ₁₀ Cl ₄	
Molecular Weight	: 320.04 g/mc	וכ
CAS-No.	: 72-54-8	
EC-No.	: 200-783-0	

Hazardous components

Component	Classification	Concentration	
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane			
	Acute Tox. 3; Acute Tox. 4;	-	
	Carc. 2; Aquatic Acute 1;		
	Aquatic Chronic 1; H301,		
	H312, H351, H410		
For the full text of the U. Otetements mentioned in this Ocetion, and Ocetion 40			

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides. Hydrogen chloride gas

Nature of decomposition products not known.

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information no data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	рН	no data available
e)	Melting point/freezing point	94.0 - 96.0 °C (201.2 - 204.8 °F)
f)	Initial boiling point and boiling range	193.0 °C (379.4 °F) at 1.3 hPa (1.0 mmHg)
g)	Flash point	no data available
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	< 0.00001 hPa (< 0.00001 mmHg) at 25.0 °C (77.0 °F)
I)	Vapour density	no data available
m)	Relative density	1.38 g/cm3
n)	Water solubility	no data available
o)	Partition coefficient: n- octanol/water	log Pow: 6.02
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available
t)	Oxidizing properties	no data available
Oth no c	her safety information	

9.2

10. STABILITY AND REACTIVITY

- 10.1 Reactivity no data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3** Possibility of hazardous reactions no data available
- **10.4** Conditions to avoid no data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - no data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Hamster - > 5,000 mg/kg

TDLo Oral - Human - 428.5 mg/kg Remarks: Endocrine:Adrenal cortex hypoplasia.

TDLo Oral - rat - 6,000 mg/kg Remarks: Cardiac:Other changes. Gastrointestinal:Other changes. Kidney, Ureter, Bladder:Changes in both tubules and glomeruli.

TDLo Oral - rat - 14 mg/kg Remarks: Liver:Changes in liver weight. Endocrine:Estrogenic. Musculoskeletal:Other changes.

TDLo Oral - rat - 2,100 mg/kg Remarks: Behavioral:Altered sleep time (including change in righting reflex).

Inhalation: no data available

LD50 Dermal - rabbit - 1,200 mg/kg Remarks: Behavioral:Excitement. Behavioral:Convulsions or effect on seizure threshold. Skin irritation

no data available

Skin corrosion/irritation no data available

Serious eye damage/eye irritation no data available

Respiratory or skin sensitisation no data available

Germ cell mutagenicity no data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

probable, possible or confirmed human carcinogen by IARC.

- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

no data available

Specific target organ toxicity - single exposure no data available

Specific target organ toxicity - repeated exposure no data available

Aspiration hazard

no data available

Additional Information

RTECS: KI0700000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

12.2

Toxicity to fish	LC50 - other fish - 1.18 - 9 mg/l - 96.0 h
	LC50 - Lepomis macrochirus (Bluegill) - 0.04 - 0.05 mg/l - 96.0 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.06 - 0.09 mg/l - 96.0 h
	LC50 - Pimephales promelas (fathead minnow) - 3.47 - 5.58 mg/l - 96.0 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia pulex (Water flea) - 0.01 mg/l - 48 h
Persistence and degrad no data available	ability

12.3 Bioaccumulative potential Indication of bioaccumulation.

12.4 Mobility in soil no data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2811 Class: 6.1 Packing group: III Proper shipping name: Toxic solids, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane) Reportable Quantity (RQ): 1 lbs Marine pollutant: No Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane) Marine pollutant: No

IATA

UN number: 2811 Class: 6.1 Packing group: III Proper shipping name: Toxic solid, organic, n.o.s. (2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane)

15. REGULATORY INFORMATION

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane	72-54-8	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	72-54-8	2007-09-28
2,2-bis(4-Chlorophenyl)-1,1-dichloro-ethane		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H301	Toxic if swallowed.
H312	Harmful in contact with skin.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	0

r no mazara.	
Reactivity Hazard:	C

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.1

Revision Date: 06/26/2014

Print Date: 05/11/2016



SAFETY DATA SHEET

Revision Date 10-Feb-2015

Revision Number 1

	1. Identificatior	1	
Product Name	p-Cymene		
Cat No. :	AC111760000; AC111760010; AC111760025; AC111760100; AC111762500		
Synonyms	Dolcymene; p-Isopropyltoluene		
Recommended Use	Laboratory chemicals.		
Uses advised against Details of the supplier of the sa	No Information available fety data sheet		
Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100	Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887	

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 3
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	
Aspiration Toxicity	Category 1

Label Elements

Signal Word Danger

Hazard Statements

Flammable liquid and vapor May be fatal if swallowed and enters airways Causes skin irritation Causes serious eye irritation May cause respiratory irritation



Precautionary Statements

Prevention

Wash face, hands and any exposed skin thoroughly after handling Wear protective gloves/protective clothing/eye protection/face protection Avoid breathing dust/fume/gas/mist/vapors/spray Use only outdoors or in a well-ventilated area Keep away from heat/sparks/open flames/hot surfaces. - No smoking Keep container tightly closed Ground/bond container and receiving equipment Use explosion-proof electrical/ventilating/lighting/equipment Use only non-sparking tools Take precautionary measures against static discharge Keep cool Inhalation IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor/physician if you feel unwell Skin If skin irritation occurs: Get medical advice/attention IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower Wash contaminated clothing before reuse Eves IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention Indestion IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician Do NOT induce vomiting Fire In case of fire: Use CO2, dry chemical, or foam for extinction Storage Store locked up Store in a well-ventilated place. Keep container tightly closed Disposal Dispose of contents/container to an approved waste disposal plant Hazards not otherwise classified (HNOC) None identified

3. Composition / information on ingredients

Component	CAS-No	Weight %
p-Cymene	99-87-6	>95

4. First-aid measures		
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.	
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.	
Inhalation	Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If	

Suitable Extinguishing Media	Water spray, Carbon dioxide (CO ₂) Dry chemical. Use water spray to cool unopened
	5. Fire-fighting measures
Notes to Physician	Treat symptomatically
Most important symptoms/effects	Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting
Ingestion	Do not induce vomiting. Clean mouth with water. Get medical attention.
	not breathing, give artificial respiration. Obtain medical attention.

 Suitable Extinguishing Media
 Water spray. Carbon dioxide (CO2). Dry chemical. Use water spray to cool unopened containers. chemical foam.

 Unsuitable Extinguishing Media
 No information available

 Flash Point
 47 °C / 116.6 °F

Method -	No information available
Autoignition Temperature	435 °C / 815 °F
Explosion Limits	
Upper	5.60%
Lower	.70%
Sensitivity to Mechanical Impa	ct No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Flammable. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA Health 3	Flammability 2	Instability 0	Physical hazards N/A	
	6. Accidental re	elease measures		
Personal Precautions Environmental Precautions	Ensure adequate ventilat See Section 12 for addition	Ensure adequate ventilation. Use personal protective equipment. See Section 12 for additional ecological information.		
Methods for Containment and Cle Up	 ean Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. 			
	7. Handling	and storage		
Handling	Avoid contact with skin an Take precautionary meas Use only non-sparking to	nd eyes. Do not breathe dust. D sures against static discharges. ols.	o not breathe vapors or spray mist. Use explosion-proof equipment.	
Storage	Keep in a dry, cool and w from heat and sources of	ell-ventilated place. Keep conta ignition. Flammables area.	iner tightly closed. Keep away	
8. 1	Exposure controls	; / personal protecti	on	
Exposure Guidelines	This product does not con established by the region	ntain any hazardous materials w specific regulatory bodies.	vith occupational exposure limits	

Engineering Measures	Ensure adequate ventilation, especially in confined areas.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physic	al and chemical properties
Physical State	Liquid
Appearance	Clear
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-68 °C / -90.4 °F
Boiling Point/Range	176 - 178 °C / 348.8 - 352.4 °F @ 760 mmHg
Flash Point	47 °C / 116.6 °F
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	5.60%
Lower	.70%
Vapor Pressure	1.5 mmHg @ 20 °C
Vapor Density	4.62 (Air = 1.0)
Relative Density	0.854
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	435 °C / 815 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C10 H14
Molecular Weight	134.22
10. 9	Stability and reactivity

Reactive Hazard	None known, based on information available	
Stability	Stable under normal conditions.	
Conditions to Avoid	Keep away from open flames, hot surfaces and sources of ignition. Excess heat. Incompatible products.	
Incompatible Materials	Strong oxidizing agents, Strong acids, Strong bases	
Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO2)		
Hazardous Polymerization	No information available.	
Hazardous Reactions	None under normal processing.	

11. Toxicological information

Acute Toxicity

Component		LD50 Oral		LD50 Dermal		LC50 Inhalation	
p-Cymene		3669 mg/kg (Rat)		Not listed	No	Not listed	
Toxicologically Syne	rgistic	No information ava	No information available				
Products	9						
Delayed and immedia	ate effects as w	ell as chronic effe	cts from short ar	d long-term expo	sure		
Irritation		No information ava	ailable				
Sensitization		No information ava	ailable				
.		-					
Carcinogenicity		The table below in	dicates whether e	ach agency has lis	ted any ingredient	as a carcinogen.	
Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico	
p-Cymene	99-87-6	Not listed	Not listed	Not listed	Not listed	Not listed	
Mutagenic Effects		Not mutagenic in A	AMES Test	. lot liotod			
Reproductive Effects		No information available.					
Developmental Effects		No information available.					
Teratogenicity		No information quailable					
Teratogenicity							
STOT - single exposi	Ire	Respiratory system					
STOT - repeated exp	osure	None known					
Aspiration hazard		No information available					
Symptoms / effects,both acute and		Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting					
delayed							
Endocrine Disruptor Information		No information ava	allable				
Other Adverse Effects		The toxicological properties have not been fully investigated. See actual entry in RTECS for					
		complete information.					

12. Ecological information

Ecotoxicity Do not empty into drains.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
p-Cymene	Not listed	LC50: 48 mg/L/96h	Not listed	LC50: 6.5 mg/L/48h
		(sheepshead minnow)		
Persistence and Degradal	bility No information	n available		

Bioaccumulation/ Accumulation No information available.

.

Mobility

Component	log Pow
p-Cymene	4.1

	13. Disposal considerations
Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

	14. Transport information
DOT	
UN-No	UN2046
Hazard Class	3
Packing Group	111
TDG	
UN-No	UN2046
Hazard Class	3
Packing Group	111
ΙΑΤΑ	
UN-No	2046
Proper Shipping Name	CYMENES
Hazard Class	3
Packing Group	111
IMDG/IMO	
UN-No	2046
Proper Shipping Name	CYMENES
Hazard Class	3
Packing Group	
15. Regulatory information	

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
p-Cymene	Х	Х	-	202-796-7	-		Х	Х	Х	Х	Х
Legend:											

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated

polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

Yes No Yes No No

U.S. Federal Regulations

TSCA 12(b)	Not applicable
SARA 313	Not applicable
SARA 311/312 Hazardous Cat Acute Health Hazard Chronic Health Hazard Fire Hazard Sudden Release of Press Reactive Hazard	tegorization ure Hazard
Clean Water Act	Not applicable
Clean Air Act	Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

California Proposition 65

This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
p-Cymene	Х	-	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

B2 Flammable liquid D2B Toxic materials



16. Other information Prepared By Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com Revision Date Print Date 10-Feb-2015 10-Feb-2015 Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.4 Revision Date 01/02/2015 Print Date 12/11/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Acenaphthene
	Product Number Brand	:	215376 Aldrich
	CAS-No.	:	83-32-9
1.2	Relevant identified uses o	f th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Manufacture of substances
1.3	Details of the supplier of t	he	safety data sheet
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Carcinogenicity (Category 1B), H350 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear eye protection/ face protection.
P280	Wear protective gloves.
P281	Use personal protective equipment as required.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if
	vou feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
	contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: 1,8-Ethylenenaphthalene
Formula Molecular weight CAS-No. EC-No.	: C ₁₂ H ₁₀ : 154.21 g/mol : 83-32-9 : 201-469-6

Hazardous components

Component	Classification	Concentration
Acenaphthene		
	Skin Irrit. 2; Eye Irrit. 2A; Carc.	<= 100 %
	1B; STOT SE 3; Aquatic Acute	
	1; Aquatic Chronic 1; H315,	
	H319, H335, H350, H410	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 90 - 94 °C (194 - 201 °F) - lit.
f)	Initial boiling point and boiling range	279 °C (534 °F) - lit.
g)	Flash point	125.0 °C (257.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available

k)	Vapour pressure	13.3 hPa (10.0 mmHg) at 131.0 °C (267.8 °F)
I)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	log Pow: 3.39 - 4.19
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	er safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Rat - 600 mg/kg

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: 3 Group 3: Not classifiable as to its carcinogenicity to humans (Acenaphthene)
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: Reasonably anticipated to be a human carcinogen (Acenaphthene)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information

RTECS: AB1000000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.67 mg/l - 96.0 h			
	LC50 - Pimephales promelas (fathead minnow) - 0.6 - 1.73 mg/l - 96.0 h			
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1.27 - 3.45 mg/l - 48 h			
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 0.52 - 0.53 mg/l - 96 h			
	· · · ···			

12.2 Persistence and degradability

12.3 Bioaccumulative potential Bioaccumulation Lepomis macrochirus (Bluegill) - 28 d - 0.00894 mg/l

Bioconcentration factor (BCF): 387

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Acenaphthene) Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Acenaphthene) Marine pollutant:yes IATA UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Acenaphthene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Acenaphthene	83-32-9	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Acenaphthene	83-32-9	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Acenaphthene	83-32-9	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	83-32-9	2007-09-28
Acenaphthene		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.

H350	May cause cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0	
Chronic Health Hazard:	*	
Flammability:	1	
Physical Hazard	0	
NFPA Rating		
NFPA Rating Health hazard:	0	
NFPA Rating Health hazard: Fire Hazard:	0 1	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.4

Revision Date: 01/02/2015

Print Date: 12/11/2015



SAFETY DATA SHEET

Revision Date 10-Feb-2015

Revision Number 1

1. Identification				
Product Name	Poly(acenaphthylene)	Poly(acenaphthylene)		
Cat No. :	AC178020000; AC178020050;	AC178020000; AC178020050; AC178020100		
Synonyms	None.	None.		
Recommended Use	Laboratory chemicals.	Laboratory chemicals.		
Uses advised against Details of the supplier of the s	No Information available safety data sheet			
Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100	Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99		

CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

Classification under 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Based on available data, the classification criteria are not met

Label Elements

None required

Hazards not otherwise classified (HNOC)

None identified

Unknown Acute Toxicity

.? % of the mixture consists of ingredients of unknown toxicity.

3. Composition / information on ingredients

Component		CAS-No	Weight %
Poly(acenaphthylene)		25036-01-5	100
4. First-aid measures			
Eye Contact	Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.		
Skin Contact	Wash off imm	nmediately with soap and plenty of water while removing all contaminated	
	clothes and shoes.		
---	--		
Inhalation	Remove from exposure, lie down. Move to fresh air.		
Ingestion	Do not induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If possible drink milk afterwards.		
Most important symptoms/effects Notes to Physician	No information available. Treat symptomatically		

5. Fire-fighting measures		
Suitable Extinguishing MediaWater spray. Carbon dioxide (CO 2). Dry chemical. alcohol-resistant foam.		
Jnsuitable Extinguishing Media No information available		
Flash Point Method -	No information available No information available	
Autoignition Temperature Explosion Limits	No information available	
Upper	No data available	
Lower	No data available	
Sensitivity to Mechanical Impac	t No information available	
Sensitivity to Static Discharge	No information available	

Specific Hazards Arising from the Chemical

Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Thermal decomposition can lead to release of irritating gases and vapors Carbon monoxide (CO) Carbon dioxide (CO₂) **Protective Equipment and Precautions for Firefighters**

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA Health 0	Flammability 0	Instability 0	Physical hazards N/A
	6. Accidental re	lease measures	
Personal Precautions Environmental Precautions	Ensure adequate ventilatio See Section 12 for additior	n. Use personal protective equipment. nal ecological information.	

Methods for Containment and Clean Sweep up or vacuum up spillage and collect in suitable container for disposal. Up

7. Handling and storage				
Handling	Avoid contact with skin and eyes. Avoid contact with clothing. Remove and wash contaminated clothing before re-use. Avoid breathing vapors or mists. Do not ingest. Was thoroughly after handling.			
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.			
	8. Exposure controls / personal protection			
Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.			

Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ventilation systems.		
Personal Protective Equipment			
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.		
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.		
Respiratory Protection	Wear a NIOSH/MSHA or European Standard EN 149 approved full-facepiece airline respirator in the positive pressure mode with emergency escape provisions.		
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.		

9. Physical and chemical properties			
Physical State Powder Solid			
Appearance	Yellow		
Odor	Odorless		
Odor Threshold	No information available		
рН	No information available		
Melting Point/Range	No data available		
Boiling Point/Range	No information available		
Flash Point	No information available		
Evaporation Rate No information available			
Flammability (solid,gas) No information available			
Flammability or explosive limits			
Upper	No data available		
Lower	No data available		
Vapor Pressure	No information available		
Vapor Density	No information available		
Relative Density	No information available		
Solubility	No information available		
Partition coefficient; n-octanol/water	No data available		
Autoignition Temperature	No information available		
Decomposition Temperature	No information available		
Viscosity	No information available		

10. Stability and reactivity

Reactive Hazard	None known, based on information available		
Stability	Stable under normal conditions.		
Conditions to Avoid	Incompatible products.		
Incompatible Materials	Oxidizing agents		
Hazardous Decomposition Products	Thermal decomposition can lead to release of irritating gases and vapors, Carbon monoxide (CO), Carbon dioxide (CO $_2$)		
Hazardous Polymerization	No information available.		
Hazardous Reactions	None under normal processing.		
	11. Toxicological information		
Acute Toxicity			
Product Information	No acute toxicity information is available for this product		

Oral LD50 Dermal LD50 Mist LC50	Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg. Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg. Based on ATE data, the classification criteria are not met. ATE > 5 mg/l.	
Component Information Toxicologically Synergistic Products	No information available	
Delayed and immediate effects as well as chronic effects from short and long-term exposure		
Irritation	No information available	

Sensitization	No information available

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Poly(acenaphthylene)	25036-01-5	Not listed	Not listed	Not listed	Not listed	Not listed
Mutagenic Effects		No information ava	ailable			
Reproductive Effect	S	No information available.				
Developmental Effe	cts	No information ava	ailable.			
Teratogenicity		No information available.				
STOT - single expos STOT - repeated exp	posure None known exposure None known					
Aspiration hazard		No information available				
Symptoms / effects	,both acute and	No information ava	ailable			
Endocrine Disruptor	r Information	No information available				
Other Adverse Effect	ets	The toxicological p	properties have not	t been fully investig	ated.	
		12. Ecol	ogical infor	mation		
Ecotoxicity						

Do not empty into drains.

Persistence and Degradability	No information available	
Bioaccumulation/Accumulation	No information available	

Mobility No information available.

 Use Disposal Methods
 Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and

national hazardous waste regulations to ensure complete and accurate classification.

	14. Transport information	
DOT	Not regulated	
TDG	Not regulated	
ΙΑΤΑ	Not regulated	
IMDG/IMO	Not regulated	
	15. Regulatory information	

International Inventories

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable
SARA 313	Not applicable

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Not applicable

Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

Clean Air Act

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

Non-controlled

16. Other information		
Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com	
Revision Date Print Date Revision Summary	10-Feb-2015 10-Feb-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)	

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS





Personal Protection	Н
Reactivity	0
Fire	3
Health	2

Material Safety Data Sheet Acetone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetone

Catalog Codes: SLA3502, SLA1645, SLA3151, SLA3808

CAS#: 67-64-1

RTECS: AL3150000

TSCA: TSCA 8(b) inventory: Acetone

Cl#: Not applicable.

Synonym: 2-propanone; Dimethyl Ketone; Dimethylformaldehyde; Pyroacetic Acid

Chemical Name: Acetone

Chemical Formula: C3-H6-O

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetone	67-64-1	100

Toxicological Data on Ingredients: Acetone: ORAL (LD50): Acute: 5800 mg/kg [Rat]. 3000 mg/kg [Mouse]. 5340 mg/kg [Rabbit]. VAPOR (LC50): Acute: 50100 mg/m 8 hours [Rat]. 44000 mg/m 4 hours [Mouse].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. The substance is toxic to central nervous system (CNS). The substance may be toxic to kidneys, the reproductive system, liver, skin. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if symptoms appear.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 465°C (869°F)

Flash Points: CLOSED CUP: -20°C (-4°F). OPEN CUP: -9°C (15.8°F) (Cleveland).

Flammable Limits: LOWER: 2.6% UPPER: 12.8%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Slightly explosive in presence of open flames and sparks, of oxidizing materials, of acids.

Fire Fighting Media and Instructions:

Flammable liquid, soluble or dispersed in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use alcohol foam, water spray or fog.

Special Remarks on Fire Hazards: Vapor may travel considerable distance to source of ignition and flash back.

Special Remarks on Explosion Hazards:

Forms explosive mixtures with hydrogen peroxide, acetic acid, nitric acid, nitric acid + sulfuric acid, chromic anydride, chromyl chloride, nitrosyl chloride, hexachloromelamine, nitrosyl perchlorate, nitryl perchlorate, permonosulfuric acid, thiodiglycol + hydrogen peroxide, potassium ter-butoxide, sulfur dichloride, 1-methyl-1,3-butadiene, bromoform, carbon, air, chloroform, thitriazylperchlorate.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container.

Large Spill:

Flammable liquid. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, acids, alkalis.

Storage:

Store in a segregated and approved area (flammables area). Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Keep away from direct sunlight and heat and avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:

Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 500 STEL: 750 (ppm) from ACGIH (TLV) [United States] TWA: 750 STEL: 1000 (ppm) from OSHA (PEL) [United States] TWA: 500 STEL: 1000 [Austalia] TWA: 1185 STEL: 2375 (mg/m3) [Australia] TWA: 750 STEL: 1500 (ppm) [United Kingdom (UK)] TWA: 1810 STEL: 3620 (mg/m3) [United Kingdom (UK)] TWA: 1800 STEL: 2400 from OSHA (PEL) [United States]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Fruity. Mint-like. Fragrant. Ethereal

Taste: Pungent, Sweetish

Molecular Weight: 58.08 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 56.2°C (133.2°F)

Melting Point: -95.35 (-139.6°F)

Critical Temperature: 235°C (455°F)

Specific Gravity: 0.79 (Water = 1)

Vapor Pressure: 24 kPa (@ 20°C)
Vapor Density: 2 (Air = 1)
Volatility: Not available.
Odor Threshold: 62 ppm
Water/Oil Dist. Coeff.: The product is more soluble in water; log(oil/water) = -0.2
Ionicity (in Water): Not available.
Dispersion Properties: See solubility in water.
Solubility: Easily soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, exposure to moisture, air, or water, incompatible materials.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, acids, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 3000 mg/kg [Mouse]. Acute toxicity of the vapor (LC50): 44000 mg/m3 4 hours [Mouse].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Reproductive system/toxin/female, Reproductive system/toxin/male [SUSPECTED]. Causes damage to the following organs: central nervous system (CNS). May cause damage to the following organs: kidneys, the reproductive system, liver, skin.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May affect genetic material (mutagenicity) based on studies with yeast (S. cerevisiae), bacteria, and hamster fibroblast cells. May cause reproductive effects (fertility) based upon animal studies. May contain trace amounts of benzene and formaldehyde which may cancer and birth defects. Human: passes the placental barrier.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause skin irritation. May be harmful if absorbed through the skin. Eyes: Causes eye irritation, characterized by a burning sensation, redness, tearing, inflammation, and possible corneal injury. Inhalation: Inhalation at high concentrations affects the sense organs, brain and causes respiratory tract irritation. It also may affect the Central Nervous System (behavior) characterized by dizzness, drowsiness, confusion, headache, muscle weakeness, and possibly motor incoordination, speech abnormalities, narcotic effects and coma. Inhalation may also affect the gastrointestinal tract (nausea, vomiting). Ingestion: May cause irritation of the digestive (gastrointestinal) tract (nausea, vomiting). It may also

affect the Central Nevous System (behavior), characterized by depression, fatigue, excitement, stupor, coma, headache, altered sleep time, ataxia, tremors as well at the blood, liver, and urinary system (kidney, bladder, ureter) and endocrine system. May also have musculoskeletal effects. Chronic Potential Health Effects: Skin: May cause dermatitis. Eyes: Eye irritation.

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 5540 mg/l 96 hours [Trout]. 8300 mg/l 96 hours [Bluegill]. 7500 mg/l 96 hours [Fatthead Minnow]. 0.1 ppm any hours [Water flea].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 3: Flammable liquid.

Identification: : Acetone UNNA: 1090 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (male) which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Benzene California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Benzene, Formaldehyde Connecticut hazardous material survey.: Acetone Illinois toxic substances disclosure to employee act: Acetone Illinois chemical safety act: Acetone New York release reporting list: Acetone Rhode Island RTK hazardous substances: Acetone Pennsylvania RTK: Acetone Florida: Acetone Minnesota: Acetone Massachusetts RTK: Acetone Massachusetts spill list: Acetone New Jersey: Acetone New Jersey spill list: Acetone Louisiana spill reporting: Acetone California List of Hazardous Substances (8 CCR 339): Acetone TSCA 8(b) inventory: Acetone TSCA 4(a) final test rules: Acetone TSCA 8(a) IUR: Acetone

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R11- Highly flammable. R36- Irritating to eyes. S9- Keep container in a well-ventilated place. S16- Keep away from sources of ignition - No smoking. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:

-Material safety data sheet issued by: la Commission de la Santé et de la Sécurité du Travail du Québec. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. LOLI, RTECS, HSDB databases. Other MSDSs

Other Special Considerations: Not available.

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Last Updated: 05/21/2013 12:00 PM

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Health	1
Fire	2
Reactivity	0
Personal Protection	J

Material Safety Data Sheet Acetophenone MSDS

Section 1: Chemical Product and Company Identification

Product Name: Acetophenone Catalog Codes: SLA2425 CAS#: 98-86-2 RTECS: AM5250000 TSCA: TSCA 8(b) inventory: Acetophenone Cl#: Not applicable. Synonym: Ketone methyl phenyl Chemical Name: 1-Phenyl-ethanone

Chemical Formula: C6H5COCH4

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Acetophenone	98-86-2	100

Toxicological Data on Ingredients: Acetophenone: ORAL (LD50): Acute: 815 mg/kg [Rat.]. 740 mg/kg [Mouse]. DERMAL (LD50): Acute: 15900 mg/kg [Rabbit].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of eye contact (irritant). Hazardous in case of skin contact (irritant). Slightly hazardous in case of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching.

Potential Chronic Health Effects:

Very hazardous in case of eye contact (irritant). Hazardous in case of skin contact (irritant). Slightly hazardous in case of ingestion, of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available.

Section 4: First Aid Measures

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Combustible.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: CLOSED CUP: 77°C (170.6°F). OPEN CUP: 82.2°C (180°F) (Cleveland).

Flammable Limits: Not available.

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Flammable in presence of open flames and sparks, of heat, of oxidizing materials.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: Store away from direct sunlight. When heated to decomposition it emits acrid smoke and fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Combustible material. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. If the product is in its solid form: Use a shovel to put the material into a convenient waste disposal container. If the product is in its liquid form:

Absorb with an inert material and put the spilled material in an appropriate waste disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapor/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, reducing agents, alkalis.

Storage:

Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 120.16 g/mole

Color: Colorless to light yellow.

pH (1% soln/water): 7 [Neutral.]

Boiling Point: 201.7°C (395.1°F)

Melting Point: 19.7°C (67.5°F)

Critical Temperature: Not available.

Specific Gravity: 1.03 (Water = 1)

Vapor Pressure: 0.1 kPa (@ 20°C)

Vapor Density: 4.1 (Air = 1)

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents, reducing agents, alkalis.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:

Acute oral toxicity (LD50): 740 mg/kg [Mouse]. Acute dermal toxicity (LD50): 15900 mg/kg [Rabbit].

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant). Slightly hazardous in case of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: 0900 Detected in maternal milk in human.

Special Remarks on other Toxic Effects on Humans:

Material is irritating to mucous membranes and upper respiratory tract. Narcotic in high concentrations. Hypnotic.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 3: Combustible liquid

Identification: : FLAMMABLE LIQUIDS, N.O.S. UNNA: UN1993 PG: Not available.

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Pennsylvania RTK: Acetophenone Massachusetts RTK: Acetophenone TSCA 8(b) inventory: Acetophenone SARA 313 toxic chemical notification and release reporting: Acetophenone CERCLA: Hazardous substances.: Acetophenone

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS B-3: Combustible liquid with a flash point between 37.8°C (100°F) and 93.3°C (200°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R22- Harmful if swallowed. R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II.

Other Special Considerations: Not available.

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SAFETY DATA SHEET

Version 4.8 Revision Date 05/03/2017 Print Date 07/13/2017

1. PRODUCT AND COMPANY IDENTIFICATION Product identifiers Product name α-Chlordane Product Number : 442449 Brand Supelco Relevant identified uses of the substance or mixture and uses advised against Identified uses : Laboratory chemicals, Synthesis of substances Details of the supplier of the safety data sheet Company Sigma-Aldrich : 3050 Spruce Street SAINT LOUIS MO 63103 USA Telephone +1 800-325-5832 +1 800-325-5052 Fax **Emergency telephone number** Emergency Phone # : +1-703-527-3887 (CHEMTREC) 2. HAZARDS IDENTIFICATION Classification of the substance or mixture GHS Classification in accordance with 29 CFR 1910 (OSHA HCS) Acute toxicity, Oral (Category 4), H302

Acute toxicity, Inhalation (Category 4), H332 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Warning

Hazard statement(s)	
H302 + H332	Harmful if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.

P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Molecular weight		409 8 a/mol
Molecular weight	•	405.0 g/moi
EC-No		225-825-5
LO-NO.	•	223-023-3

Hazardous components

Component	Classification	Concentration
Chlordane		
	Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H302 + H332, H315, H319, H335, H351, H410	90 - 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2 Most important symptoms and effects, both acute and delayed** The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture No data available

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values. Hazardous components without workplace control parameters

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	93.0 - 94.0 °C (199.4 - 201.2 °F)
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available

i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Othe	r safety information	

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents

10.6 Hazardous decomposition products Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen chloride gas Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 500 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: 2B Group 2B: Possibly carcinogenic to humans (Chlordane)
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: Not available

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Lepomis macrochirus (Bluegill) - 0.0074 mg/l - 96 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

Bioaccumulation Lepomis macrochirus (Bluegill) - 24 h - 0.005 mg/l

Bioconcentration factor (BCF): 322

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Chlordane) Reportable Quantity (RQ): Marine pollutant:yes Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Chlordane) Marine pollutant:yes

ΙΑΤΑ

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Chlordane)

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Chlordane	CAS-No. 5103-71-9	Revision Date
Chlordane	CAS-No. 5103-71-9	Revision Date
New Jersey Right To Know Components		
Chlordane	CAS-No. 5103-71-9	Revision Date
	0100710	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H302	Harmful if swallowed.
H302 + H332	Harmful if swallowed or if inhaled
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H335	May cause respiratory irritation.

HMIS Rating

Health hazard:	2
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0

Reactivity Hazard:

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.8

Revision Date: 05/03/2017

Print Date: 07/13/2017



SAFETY DATA SHEET

1. Identification

Product identifier	ATOMIZED ALUMINUM POWDER
Other means of identification	
SDS number	123
Chemical formula	Al
Version #	08
Revision date	August 11, 2015.
Other means of identification	
Synonyms	All non-alloyed, non-coated nodular aluminum powder containing < 1% trace elements * Grade 13, 101, 102, 104, 101T, 120, 121, 123, 1124, 1202, 1233, 1235, 1401/S2(1406), 1403, 1404, 1407, 1401/S9(1409), 1125, * 4402, 6401, 7123, 7124, 7125, 7401
Recommended use	Various metallurgical/chemical/structural/coating applications
Recommended restrictions	None known.
Manufacturer/Importer/Supplier/ Manufacturer	Distributor information
	Alcoa Inc. 201 Isabella Street Pittsburgh, PA USA 15212 Health and Safety Tel: +1-412-553-4649 Health and Safety Fax: +1-412-553-4822 Health and Safety Email: accmsds@alcoa.com
	Rockdale Operations P.O. Box 472 Rockdale, TX 76567 Tel: +1-512-446-8681
	Rodovia Poços de Caldas/Andradas, km 10 CEP 37.719-900 Poços de Caldas, Minas Gerais Tel.: (+55 35) 2101-5000 E-mail: pfacomercialprimarios@alcoa.com.br
Emergency Information	CHEMTREC: +1-703-527-3887 +1-800-424-9300 (24 Hour Emergency Telephone, multiple languages spoken); ALCOA: +1-412-553-4001 (24 Hour Emergency Telephone, only English spoken)
Website	For a current Safety Data Sheet, refer to Alcoa websites: www.alcoa.com or internally at my.alcoa.com EHS Community
2. Hazard(s) identification	
Physical hazards	Not classified.
Health hazards	Not classified.
Environmental hazards	Not classified.
Authority defined hazards	Combustible dust
Label elements	
Hazard symbol	None.
Signal word	Warning
Hazard statement	May form combustible dust concentrations in air.

Precautionary statement	
Prevention	Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Use only non-sparking tools and natural bristle brushes. Keep away from heat/sparks/open flames/hot surfaces No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Prevent dust accumulation to minimize explosion hazard. Take precautionary measures against static discharge.
Response	In case of fire: Use appropriate media for extinction.
Storage	Store in a dry place and/or in closed container. Keep away from heat, sparks and open flame - No smoking.Do not allow chips, fines or dust to contact water, particularly in enclosed areas.
Disposal	Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal.
Hazard(s) not otherwise classified (HNOC)	None known.
Supplemental information	Powder may ignite readily. Powder or dusts dispersed in the air can be explosive.
	Explosion/fire hazards may be present when: • Powder or dust are dispersed in air. • Powder or dusts are in contact with water.

• Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).

3. Composition/information on ingredients

Composition comments Complete composition is provided below and may include some components classified as non-hazardous.

Substances			
Chemical name	Common name and synonyms	CAS number	%
Aluminum powder		7429-90-5	≥99.7

4. First-aid measures

Eye contact	Dust from processing: Rinse eyes with plenty of water or saline for at least 15 minutes. Consult a physician.
Skin contact	Dust from processing: Wash with soap and water for at least 15 minutes. Get medical attention if irritation develops or persists.
Inhalation	Dust from processing: Remove to fresh air. Check for clear airway, breathing, and presence of pulse. If breathing is difficult, provide oxygen. Loosen any tight clothing on neck or chest. Provide cardiopulmonary resuscitation for persons without pulse or respirations. Consult a physician.
Ingestion	If swallowed, dilute by drinking water. Recommend quantities up to 30 mL (~1 oz.) in children and 250 mL (~9 oz.) in adults. Never give anything by mouth to a victim who is unconscious or is having convulsions. Do NOT induce vomiting. Consult a physician.
Most important symptoms/effects, acute and delayed	Dust from processing: Can cause irritation of the upper respiratory tract. See Section 11 of the SDS for additional information on health hazards.
Medical conditions aggravated by exposure	Asthma, chronic lung disease, and skin rashes.
Indication of immediate medical attention and special treatment needed	Provide general supportive measures and treat symptomatically. In case of shortness of breath, give oxygen.
General information	If exposed or concerned: Get medical advice/attention. In case of shortness of breath, give oxygen.

5. Fire-fighting measures

Suitable extinguishing media	Use Class D extinguishing agents on fines, dust or molten metal.
Unsuitable extinguishing media	DO NOT USE water, halogenated agents, or ABC dry chemical agents. These fire extinguishing agents will react with the burning material.

Specific hazards arising from the chemical	 Alcoa aluminum powders were tested by the United States Department of Interior Bureau of Mines in 1991, under UN criteria and found not to meet the definition of a hazard class 4. Care should be taken, however, during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. May be a potential hazard under the following conditions: Dust clouds may be explosive. Even a minor dust cloud can explode violently. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions. Powder or dusts in contact with water can generate flammable/explosive hydrogen gas. These gases could present an explosion hazard in confined or poorly ventilated spaces. Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).
Special protective equipment and precautions for firefighters	Firefighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.
Fire fighting equipment/instructions	Use gentle surface application of Class D extinguishing agent or dry inert granular material (e.g., sand) to cover and ring the burning material. Avoid mixing of the extinguishing agent with the burning material. Apply extinguishing media carefully to avoid creating airborne dust. Do not disturb the material until completely cool. If possible, isolate the burning material to prevent fire spread, and allow the material to burn itself out. Move undamaged containers away from heat or flame, if possible.
General fire hazards	Dust and fines from processing may ignite readily. Dust or fines dispersed in the air can be explosive.
Explosion data	
Sensitivity to mechanical impact	Not sensitive.
Sensitivity to static discharge	Static electricity and formation of sparks must be prevented. Prevent electrostatic charge build-up by using common bonding and grounding techniques. Use non-sparking handling equipment, tools and natural bristle brushes. Cover and reseal partially empty containers. Provide grounding and bonding where necessary to prevent accumulation of static charges during metal dust handling and transfer operations.
	Obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin F-1 and National Fire Protection Association (NFPA) Standards listed in Section 16.
	Use non-sparking handling equipment, tools and natural bristle brushes. Cover and reseal partially empty containers. Provide grounding and bonding where necessary to prevent accumulation of static charges during metal dust handling and transfer operations (See Section 15).
6. Accidental release meas	ures
Personal precautions, protective equipment and emergency procedures	Avoid contact with skin and eyes. Use personal protection recommended in Section 8 of the SDS.
Personal precautions, protective	equipment and emergency procedures
For emergency responders	Avoid contact with skin and eyes. Use personal protection recommended in Section 8 of the SDS.
Evacuation procedures	Keep people away from and upwind of spill/leak. Keep unnecessary personnel away.
Methods and materials for containment and cleaning up	Isolate area. Avoid the generation of dusts during clean-up. Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). Use only non-sparking tools and natural bristle brushes. Use dry cleanup procedures.
	Keep material dry. Place carefully in dry, water-tight containers. Seal containers. After complete clean-up by sweeping, area may be washed with large amounts of water if necessary. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal. For waste disposal, see section 13 of the SDS.
Environmental precautions	No specific precautions.

7. Handling and storage

	0	•	
Handling			Keep away from sources of ignition - No smoking. Avoid contact with skin and eyes. Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Keep material dry.
Storage			Keep dry. Storage rooms must be of fire-resistant construction. Do not store powder in same room as other combustible materials.

Obtain and follow the safety procedures and equipment guides contained in Aluminum Association Bulletin TR-2 and National Fire Protection Association (NFPA) brochures listed in Section 16. Use non-sparking handling equipment, tools and natural bristle brush. Cover and reseal partially empty containers. Provide grounding and bonding where necessary to prevent accumulation of static charges during metal dust handling and transfer operations (See Section 15).

Local ventilation and vacuum systems must be designed to handle explosive dusts. Dry vacuums and electrostatic precipitators must not be used, unless specifically approved for use with flammable/explosive dusts. Dust collection systems must be dedicated to aluminum dust only and should be clearly labeled as such. Do not co-mingle fines of aluminum with fines of iron, iron oxide (rust) or other metal oxides.

Process equipment, storage containers, vessels and buildings should be equipped with explosion/pressure relief valves, panels and windows. Precautions must also be taken to prevent water leakage or seepage which could contact the powder. Refer to NFPA 484.

Avoid all ignition sources. Good housekeeping practices must be maintained. Dust accumulation on the floor, ledges and beams can present a risk of ignition, flame propagation and secondary explosions. Do not use compressed air to remove settled material from floors, beams or equipment . Do not allow fines or dust to contact water, particularly in enclosed areas.

8. Exposure controls/personal protection

Oc	cupational exposure limits				
	U.S OSHA			_	
	Components	Туре	Value	Form	
	Aluminum powder (CAS 7429-90-5)	TWA	15 mg/m3	(total dust)	
	US. OSHA Table Z-1 Limits	s for Air Contaminants (29 CFR 1910.1000)			
	Material	Туре	Value	Form	
	ATOMIZED ALUMINUM POWDER	PEL	5 mg/m3	Respirable dust.	
			15 mg/m3	Total dust.	
	Components	Туре	Value	Form	
	Aluminum powder (CAS 7429-90-5)	TWA	5 mg/m3	Respirable dust.	
	US ACGIH Threshold Limi	t Values: Time Weighted Average (TWA): mg/n	n3, non-standard uni	its	
	Material	Туре	Value	Form	
	ATOMIZED ALUMINUM POWDER	TWA	1 mg/m3	Respirable fraction.	
	Components	Туре	Value	Form	
	Aluminum powder (CAS 7429-90-5)	TWA	1 mg/m3	Respirable fraction.	
	Alcoa				
	Material	Туре	Value	Form	
	ATOMIZED ALUMINUM POWDER	TWA	3 mg/m3	Respirable fraction	
			10 mg/m3	Total dust	
	Components	Туре	Value	Form	
	Aluminum powder (CAS 7429-90-5)	TWA	3 mg/m3	Respirable fraction	
	,		10 mg/m3	Total dust	
Ge	eneral	Use personal protective equipment as require	d.		
Ap co	propriate engineering ntrols	Dust from processing: Use with adequate explosion-proof ventilation designed to handle particulates to meet the limits listed in Section 8, Exposure Guidelines.			
Inc	dividual protection measure	s, such as personal protective equipment			
	Eye/face protection	Wear safety glasses with side shields.			
	Skin protection				
	Hand protection	Wear impervious gloves to avoid direct skin contact.			

Other	Recommend fire resistant cotton or equivalent full-length fire resistant pants and jackets along with electrically conductive safety shoes or grounding straps. Great caution is required to avoid contact with unprotected electrical devices when wearing conductive safety shoes or grounding straps.
Respiratory protection	Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 8. Suggested respiratory protection: N95.
Thermal hazards	Not applicable.
General hygiene considerations Control parameters	Handle in accordance with good industrial hygiene and safety practice. When using, do not eat, drink or smoke. Wash hands before breaks and immediately after handling the product.

9. Physical and chemical properties

Form	Solid, powder.		
Color	Silvery to gray.		
Odor	Odorless		
Odor threshold	Not applicable		
рН	Not applicable		
Density	0.80 - 1.30 g/cm3		
Melting point/freezing point	1194.8 - 1214.6 °F (646 - 657 °C) 1220 °F (660 °C)		
Initial boiling point and boiling range	Not determined		
	4220.6 °F (2327 °C)		
Flash point	Not applicable		
Evaporation rate	Not applicable		
Flammability (solid, gas)	Not applicable.		
Upper/lower flammability or expl	osive limits		
Flammability limit - upper (%)	Not determined		
Flammability limit - lower (%)	40 mg/l		
Explosive properties	Dust can form an explosive mixture in air. Dust accumulation from this product may present an explosion hazard in the presence of an ignition source.		
Dust explosion properties			
St class	Very strong explosion.		
Vapor pressure	Not applicable		
Vapor density	Not applicable		
Relative density	Not determined		
Solubility(ies)	Insoluble Insoluble		
Partition coefficient (n-octanol/water)	Not applicable. Not applicable		
Auto-ignition temperature	1202 °F (650 °C) layered		
Decomposition temperature	Not applicable		
Viscosity	Not applicable		
10. Stability and reactivity			

Reactivity	The product is stable and non-reactive under normal conditions of use, storage and transport.		
Chemical stability	Stable under normal conditions of use, storage, and transportation as shipped.		
Possibility of hazardous reactions	Hazardous polymerization does not occur.		
Conditions to avoid	 Water: Slowly generates flammable and explosive hydrogen gas and heat. Generation rate is greatly increased with smaller particles (e.g., fines and dusts). Water/aluminum mixtures may be hazardous when confined. 		

• Heat: Oxidizes at a rate dependent upon temperature and particle size.

Incompatible materials	 Acids and alkalis: Reacts to generate flammable/explosive hydrogen gas. Generation rate is greatly increased with smaller particles (e.g., fines and dusts). Strong oxidizers: Violent reaction with considerable heat generation. Can react explosively with nitrates (e.g., ammonium nitrate and fertilizers containing nitrate) when heated or molten. Halogenated compounds: Many halogenated hydrocarbons, including halogenated fire extinguishing agents, can react violently with finely divided or molten aluminum. Iron oxide (rust) and other metal oxides (e.g., copper and lead oxides): A violent thermite reaction generating considerable heat can occur. Reaction with aluminum fines and dusts requires only very weak ignition sources for initiation. Iron powder and water: Explosive reaction forming hydrogen gas when heated above 1470°F (800°C).
Hazardous decomposition products	No hazardous decomposition products are known.

11. Toxicological information

Health effects associated with ingredients

Aluminum dust/fines and fumes: Low health risk by inhalation. Generally considered to be biologically inert.

Health effects associated with compounds formed during processing

No new/additional compounds are expected to be formed during processing.

Information on likely routes of exposure

Eye contact	Can cause mechanical irritation.		
Skin contact	Dust from processing: Can cause mechanical irritation.		
Inhalation	Dust from processing: Can cause irritation of the upper respiratory tract.		
Ingestion	Can cause irritation of the gastrointestinal tract.		
Symptoms related to the physical, chemical and toxicological characteristics	Dust from processing: Can cause mechanical irritation. Dust: Can cause irritation of the upper respiratory tract.		

Information on toxicological effects

Acute toxicity	Based on available data, the classification criteria are not met.
Skin corrosion/irritation	Non-corrosive.
Serious eye damage/eye irritation	Can cause mechanical irritation.

Respiratory or skin sensitization

Respiratory sensitization	Not a respiratory sensitizer.	
Skin sensitization	Not a skin sensitizer.	
Germ cell mutagenicity	Based on available data, the classification criteria are not met.	
Neurological effects	Based on available data, the classification criteria are not met.	
Pre-existing conditions aggravated by exposure	Asthma, chronic lung disease, and skin rashes.	
Carcinogenicity	Does not present any cancer hazards.	
Reproductive toxicity	Does not present any reproductive hazards.	
Routes of exposure	Inhalation. Skin contact. Eye contact.	
Specific target organ toxicity - single exposure	Based on available data, the classification criteria are not met.	
Specific target organ toxicity - repeated exposure	Based on available data, the classification criteria are not met.	
Aspiration hazard	Not an aspiration hazard.	
Chronic effects	Not classified.	
Further information	None known.	

12. Ecological information

Ecotoxicity

Not expected to be harmful to aquatic organisms.

Product		Species	Test Results
ATOMIZED ALUMINUM PO	WDER		
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	0.16 mg/l, 96 hours
Persistence and degradability	The produ	ict is not biodegradable.	
Bioaccumulative potential	The produ	ict does not contain any substances expe	cted to be bioaccumulating.
Mobility in soil	Not consid	dered mobile.	
Mobility in general	Not consid	dered mobile.	
Other adverse effects	Not availa	ble.	

13. Disposal considerations

Disposal instructions	Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered non-reactive prior to disposal.	
Local disposal regulations	Dispose in accordance with all applicable regulations.	
Waste codes	RCRA Status: Not federally regulated in the U.S. if disposed of "as is." RCRA waste codes other than described here may apply depending on use of the product. Status must be determined at the point of waste generation. Refer to 40 CFR 261 or state equivalent in the U.S.	
Waste from residues / unused products	If reuse or recycling is not possible, disposal must be made according to local or governmental regulations.	
Contaminated packaging	Dispose of in accordance with local regulations.	

14. Transport information

General Shipping Information

Basic	Shipping	Information

ID number	-
Proper shipping name	Not regulated
Hazard class	-
Packing group	-

General Shipping Notes

• This material has been tested under UN criteria and found not to meet the definition of a hazard class 4 and does not meet the definition of any other hazard class.

• Standard Transportation Commodity Code: 33-991-19.

• HTS (Harmonized Tariff Schedule) code: 7603.10.0000.

• The import/export HTS (Harmonized Tariff Schedule) code given above is the United States HTS code provided by Alcoa's Customs Compliance Office in Knoxville, TN. Other country specific HTS codes may apply. If available, more information on the HTS codes will be provided on country specific Material Safety Data Sheets.

• When "Not regulated", enter the proper freight classification, SDS Number and Product Name onto the shipping paperwork.

Disclaimer

This section provides basic classification information and, where relevant, information with respect to specific modal regulations, environmental hazards and special precautions. Otherwise, it is presumed that the information is not available/not relevant

15. Regulatory information

US federal regulations

In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.

All electrical equipment must be suitable for use in hazardous atmospheres involving aluminum powder in accordance with 29 CFR 1910.307. The National Electrical Code, NFPA 70, contains guidelines for determining the type and design of equipment and installation which will meet this requirement.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

CERCLA Hazardous Substance List (40 CFR 302.4)

Not listed.

Su	perfund Amendments and Rea	authorization Act of 1980	6 (SARA)		
	Section 311/312 hazard categories	Immediate Hazard - No Delayed Hazard - No Fire Hazard - No Pressure Hazard - Yes Reactivity Hazard - No		If dust clouds are ge	enerated
	SARA 302 Extremely hazard Not listed.	ous substance			
	SARA 311/312 Hazardous chemical	Yes			
	SARA 313 (TRI reporting) Chemical name		CAS number	% by wt.	
	Aluminum powder		7429-90-5	≥99.7	
US	state regulations US. California Proposition 6 Not Listed.	5			
Inte	ernational Inventories				
	Country(s) or region	Inventory name			On inventory (yes/no)*
	Australia	Australian Inventory of C	Chemical Substances (A	AICS)	Yes
	Canada	Domestic Substances Li	st (DSL)		Yes
	Canada	Non-Domestic Substanc	es List (NDSL)		No
	China	Inventory of Existing Che	emical Substances in C	china (IECSC)	Yes
	Europe	European Inventory of E Substances (EINECS)	xisting Commercial Ch		Yes
	Europe	European List of Notified	Chemical Substances	(ELINCS)	No
	Japan	Inventory of Existing and	New Chemical Substa	ances (ENCS)	No
	Korea	Existing Chemicals List ((ECL)		Yes
	New Zealand	New Zealand Inventory			Yes
	Philippines	(PICCS)	hemicals and Chemica	Il Substances	Yes
	United States & Puerto Rico *A "Yes" indicates that all compon A "No" indicates that one or more country(s).	Toxic Substances Contro nents of this product comply w components of the product a	bl Act (TSCA) Inventory with the inventory requirem re not listed or exempt fro	/ nents administered by the m listing on the inventory	Yes governing country(s) administered by the governing
16	. Other information, incl	uding date of prepa	ration or last revis	sion	
SDS Status		August 11, 2015: Chang April 30, 2015 (April 30, modification January 7, 2015: Chang Origination date: Septem	e(s) in Section: 1 and 1 2015 Minor modificatio e(s) in Section: 1, 2, 3, nber 17, 1980	l6. n 0123usa): Change(s 4, 5, 6, 7, 8, 9, 10, 11,) in Section: 1, 2 Minor 12, 13, 14, 15 and 16.
		Hazardous Materials Control Committee Preparer: Jim Perriello, +1-865-977-2051.			
		SDS System Number: 14	45308		
Revision date		August 11, 2015.			
ver	sion #	08 Decident and Ocean and I	la stifica ti su Osmania		
Rev	vision information	Composition / Informatio Physical & Chemical Pro Transport Information: A Regulatory Information: HazReg Data: North Am GHS: Classification	on on Ingredients: Discloperties: Multiple Prope gency Name, Packagir United States erica	s osure Overrides rties ng Type, and Transport	t Mode Selection
Dis	claimer	The information in the sh available.	neet was written based	on the best knowledge	e and experience currently

Other information

• Aluminum Association Bulletin TR-2, "Recommendations for Storage and Handling of Aluminum Pigments and Powders." The Aluminum Association, 1525 Wilson Boulevard, Suite 600, Arlington, Virginia 22209, www.aluminum.org.

• Aluminum Association, "Guidelines for Handling Molten Aluminum, The Aluminum Association, 1525 Wilson Boulevard, Suite 600, Arlington, Virginia 22209, www.aluminum.org.

• NFPA 484, Standard for Combustible Metals (NFPA phone: 800-344-3555)

• NFPA 654, Standard for the Prevention of Fire and Dust Explosions from the Manufacturing, Processing, and Handling of Combustible Particulate Solids

• NFPA 70, Standard for National Electrical Code (Electrical Equipment, Grounding and Bonding)

• NFPA 77, Standard for Static Electricity

• NFPA 68, Standard on Explosion Protection by Deflagration Venting • NFPA 69, Standard on Explosion Prevention Systems Key/Legend:

ACGIH American Conference of Governmental Industrial Hygienists

- AICS Australian Inventory of Chemical Substances
- CAS Chemical Abstract Services
- CERCLA Comprehensive Environmental Response, Compensation, and Liability Act
- CFR Code of Federal Regulations
- CPR Cardio-pulmonary Resuscitation
- DOT Department of Transportation
- DSL Domestic Substances List (Canada)
- EC Effective Concentration
- ED Effective Dose
- EINECS European Inventory of Existing Commercial Chemical Substances
- ENCS Japan Existing and New Chemical Substances
- EWC European Waste Catalogue
- EPA Environmental Protective Agency
- IARC International Agency for Research on Cancer
- LC Lethal Concentration
- LD Lethal Dose
- MAK Maximum Workplace Concentration (Germany) "maximale Arbeitsplatz-Konzentration"
- NDSL Non-Domestic Substances List (Canada)
- NIOSH National Institute for Occupational Safety and Health
- NTP National Toxicology Program
- OEL Occupational Exposure Limit
- OSHA Occupational Safety and Health Administration
- PIN Product Identification Number
- PMCC Pensky Marten Closed Cup
- RCRA Resource Conservation and Recovery Act
- SARA Superfund Amendments and Reauthorization Act
- SIMDUT Système d'Information sur les Matières Dangereuses Utilisées au Travail
- STEL Short Term Exposure Limit
- TCLP Toxic Chemicals Leachate Program
- TDG Transportation of Dangerous Goods
- TLV Threshold Limit Value
- TSCA Toxic Substances Control Act
- TWA Time Weighted Average
- WHMIS Workplace Hazardous Materials Information System
- m meter, cm centimeter, mm millimeter, in inch,
- g gram, kg kilogram, lb pound, µg microgram,

ppm parts per million, ft feet

*** End of SDS ***

Hazard statement

May form combustible dust concentrations in air.

Precautionary statement

Prevention

Care should be taken during bulk handling to prevent accumulation/generation over time of 75 micron or finer particles. Use only non-sparking tools and natural bristle brushes. Keep away from heat/sparks/open flames/hot surfaces - No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Prevent dust accumulation to minimize explosion hazard. Take precautionary measures against static discharge.

Response

In case of fire: Use appropriate media for extinction.

Storage

Store in a dry place and/or in closed container. Keep away from heat, sparks and open flame - No smoking. Do not allow chips, fines or dust to contact water, particularly in enclosed areas.

Disposal

Reuse or recycle material whenever possible. Material that cannot be reused may be sent to a metals reclamation facility that is able to handle fines. Waste material that cannot be reclaimed for metal value should be rendered nonreactive prior to disposal.

Warning

Supplemental information

Powder may ignite readily. Powder or dusts dispersed in the air can be explosive.

Explosion/fire hazards may be present when:

- Powder or dust are dispersed in air.
- Powder or dusts are in contact with water.
- Powder or dusts are in contact with certain metal oxides (e.g., rust, copper oxide).

FIRE FIGHTING MEASURES: Use gentle surface application of Class D extinguishing agent or dry inert granular material (e.g., sand) to cover and ring the burning material. Avoid mixing of the extinguishing agent with the burning material. If possible, isolate the burning material to prevent fire spread, and allow the material to burn itself out. Do not disturb the material until completely cool. Move undamaged containers away from heat or flame, if possible.

DO NOT USE water, halogenated agents, or ABC dry chemical agents. These fire extinguishing agents will react with the burning material.

IN CASE OF SPILL: Avoid dusting of powder to the greatest extent possible. Use only non-sparking tools and natural bristle brushes. ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Prohibit smoking. Use dry cleanup procedures. Place carefully in dry, water-tight containers. Seal containers. After complete clean-up by sweeping, area may be washed with large amounts of water if necessary.

See Alcoa SDS Number 0123.

Chemtrec: +1-703-527-3887 +1-800-424-9300 (24 Hour Emergency Telephone, multiple languages spoken)



sigma-aldrich.com

SAFETY DATA SHEET

Version 4.9 Revision Date 04/20/2015 Print Date 12/11/2015

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Anthracene		
	Product Number Brand	:	A89200 Aldrich		
	CAS-No.	:	120-12-7		
1.2	Relevant identified uses of the substance or mixture and uses advised against				
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Warning

Hazard statement(s) H315 H319	Causes skin irritation. Causes serious eye irritation.
n333	may cause respiratory initiation.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear eye protection/ face protection.
P280 P302 + P352 P304 + P340 + P312	Wear protective gloves. IF ON SKIN: Wash with plenty of soap and water. IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
---	--
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS Photosensitizer., Lachrymator.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

:	C ₁₄ H ₁₀
:	178.23 g/mol
:	120-12-7
:	204-371-1
	:

Hazardous components

Component	Classification	Concentration
Anthracene Included in the Candidate List o Regulation (EC) No. 1907/2006 (REACH)	f Substances of Very High Concern (SVHC)	according to
	Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 1; H315, H319, H335, H410	<= 100 %
For the full text of the H-Statements mention	ed in this Section see Section 16	

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture No data available

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component			Control	Decia
Component	CAS-NO.	value	Control	Basis
			parameters	
Anthracene	120-12-7	TWA	0.200000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
			-	Contaminants
	Remarks	1910.1002		
		As used in §1910.1000 (Table Z-1), coal tar pitch volatiles include the fused polycyclic hydrocarbons which volatilize from the distillation residues of coal, petroleum (excluding asphalt), wood, and other organic matter. Asphalt (CAS 8052-42-4, and CAS 64742-93-4) is not covered under the 'coal tar pitch volatiles'		
		standard		
		USHA Speci	ically regulated ca	rcinogen

TWA	0.100000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
Potential Occ	cupational Carcino	gen
NIOSH cons	iders coal tar, coal	tar pitch, and creosote to be coal tar
products.		
cyclohexane	-extractable fractio	n
See Appendi	ix C	
See Appendi	ix A	

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological	Basis
				specimen	
Anthracene	120-12-7	1-		Urine	ACGIH - Biological
		Hydroxypyren			Exposure Indices
		e (1-HP)			(BEI)
	Remarks	End of shift at e	end of workv	veek	

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Chloroprene Minimum layer thickness: 0.6 mm Break through time: 480 min Material tested:Camapren® (KCL 722 / Aldrich Z677493, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 30 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: beige
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 210 - 215 °C (410 - 419 °F) - lit.
f)	Initial boiling point and boiling range	340 °C (644 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Lower explosion limit: 0.6 %(V)
k)	Vapour pressure	1.3 hPa (1.0 mmHg) at 145.0 °C (293.0 °F)
I)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	log Pow: 4.45
p)	Auto-ignition temperature	540.0 °C (1,004.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1	Reactivity
	No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents, Hypochlorites
- **10.6 Hazardous decomposition products** Other decomposition products - No data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Inhalation: No data available

Dermal: No data available

LD50 Intraperitoneal - Mouse - 430 mg/kg

Skin corrosion/irritation

Skin - Mouse Result: Mild skin irritation

Serious eye damage/eye irritation

Irritating to eyes. The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

Respiratory or skin sensitisation

Causes photosensitivity. Exposure to light can result in allergic reactions resulting in dermatologic lesions, which can vary from sunburnlike responses to edematous, vesiculated lesions, or bullae

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: 3 Group 3: Not classifiable as to its carcinogenicity to humans (Anthracene)
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: OSHA specifically regulated carcinogen (Anthracene)

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure

Inhalation - May cause respiratory irritation.

The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: CA9350000

Possible tumor promoter., Headache, Nausea, Weakness

Blood -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fishLC50 - Lepomis macrochirus (Bluegill) - 0.001 mg/l - 96.0 hToxicity to daphnia and
other aquatic
invertebratesEC50 - Daphnia magna (Water flea) - 0.10 mg/l - 48 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential

Indication of bioaccumulation.

Bioaccumulation

Pimephales promelas (fathead minnow) - 42 d - 0.01191 mg/l

Bioconcentration factor (BCF): 649

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Anthracene) Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Anthracene) Marine pollutant:yes IATA UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Anthracene)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Anthracene	120-12-7	2007-07-01

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Anthracene	120-12-7	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Anthracene	120-12-7	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Anthracene	120-12-7	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Anthracene	120-12-7	2007-09-28
State of California to cause cancer.	120-12-7	2007-09-28
Anthracene		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	0
Depathultur Llamardu	~

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.9

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Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations Revision Date: 02/12/2014

Version: 1.0

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY

Product Identifier 1.1.

Product Form: Substance Product Name: Antimony Synonyms: Stibium (Sb)

1.2. Intended Use of the Product No additional information available

1.3. Name, Address, and Telephone of the Responsible Party

Company

Atomized Products Group, Inc 3838 Miller Park Dr Garland, TX 75042 T 972-272-9596 atomizedproductsgroup.com

1.4. **Emergency Telephone Number**

Emergency Number

: 800-255-3924 (CHEMTEL)

SECTION 2: HAZARDS IDENTIFICATION

Classification of the Substance or Mixture 2.1.

Classification (GHS-US) Comb. Dust Acute Tox. 3 (Oral) H301 Acute Tox. 4 H332 (Inhalation:dust,mist) Carc. 2 H351 Aquatic Acute 2 H401 Aquatic Chronic 2 H411 **Label Elements** 2.2. **GHS-US Labeling** Hazard Pictograms (GHS-US)

Hazard Pictograms (GHS-US)	
	GHS06 GHS07 GHS08 GHS09
Signal Word (GHS-US)	: Danger
Hazard Statements (GHS-US)	: May form combustible dust concentrations in air
	H301 - Toxic if swallowed
	H332 - Harmful if inhaled
	H351 - Suspected of causing cancer
	H401 - Toxic to aquatic life
	H411 - Toxic to aquatic life with long lasting effects
Precautionary Statements (GHS-US)	: P201 - Obtain special instructions before use.
	P202 - Do not handle until all safety precautions have been read and understood.
	P261 - Avoid breathing dust.
	P264 - Wash hands, forearms, and other exposed areas thoroughly after handling.
	P270 - Do not eat, drink or smoke when using this product.
	P271 - Use only outdoors or in a well-ventilated area.
	P273 - Avoid release to the environment.
	P280 - Wear protective gloves, protective clothing, eye protection, face protection,
	respiratory protection.
	P301+P310 - IF SWALLOWED: Immediately call a POISON CENTER or
	doctor/physician.
	P304+P340 - IF INHALED: Remove victim to fresh air and keep at rest in a position
	comfortable for breathing.
	P308+P313 - IT exposed or concerned: Get medical advice/attention.

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P312 - Call a POISON CENTER/doctor/physician if you feel unwell.

P321 - Specific treatment (see section 4).

P330 - If swallowed, rinse mouth.

P391 - Collect spillage.

P405 - Store locked up.

P501 - Dispose of contents/container to local, regional, national, territorial,

provincial, and international regulations.

2.3. Other Hazards

Other Hazards Not Contributing to the Classification: Exposure may aggravate those with pre-existing eye, skin, or respiratory conditions. May form combustible dust concentrations in air. Exposure may aggravate individuals with pre-existing skin, kidney, liver, and pulmonary disorders. On burning release of harmful/irritant gases/vapours (antimony oxides). Inhalation of dusts and fumes can cause metal fume fever. Symptoms can include a metallic or sweet taste in the mouth, sweating, shivering, headache, throat irritation, fever, chills, thirstiness, muscle aches, nausea, vomiting, weakness, fatigue, and shortness of breath.

2.4. Unknown Acute Toxicity (GHS-US)

No data available

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.1. Substance

Name

: Antimony

Name	Product identifier	%	Classification (GHS-US)
Antimony	(CAS No) 7440-36-0	100	Comb. Dust Acute Tox. 3 (Oral), H301 Acute Tox. 4 (Inhalation), H332 Carc. 2, H351 Aquatic Acute 2, H401 Aquatic Chronic 2, H411

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: FIRST AID MEASURES

4.1. Description of First Aid Measures

First-aid Measures General: Never give anything by mouth to an unconscious person. If you feel unwell, seek medical advice (show the label where possible).

First-aid Measures After Inhalation: When symptoms occur: go into open air and ventilate suspected area. Obtain medical attention if breathing difficulty persists.

First-aid Measures After Skin Contact: Remove contaminated clothing. Drench affected area with water for at least 15 minutes. Obtain medical attention if irritation persists.

First-aid Measures After Eye Contact: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Obtain medical attention if irritation persists.

First-aid Measures After Ingestion: Rinse mouth. Do not induce vomiting. Seek medical attention if a large amount is swallowed.
4.2. Most important symptoms and effects, both acute and delayed

Symptoms/Injuries: Suspected of causing cancer. Toxic if swallowed. Harmful if inhaled.

Symptoms/Injuries After Inhalation: Harmful if inhaled. Respiratory tract irritation.

Symptoms/Injuries After Skin Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Eye Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Ingestion: Toxic if swallowed. May cause nausea, vomiting, and diarrhea.

Chronic Symptoms: Prolonged exposure may cause effects in specific organs such as the liver, kidneys, blood, and nervous system.

4.3. Indication of Any Immediate Medical Attention and Special Treatment Needed

If exposed or concerned, get medical advice and attention.

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing Media

Suitable Extinguishing Media: Use extinguishing media appropriate for surrounding fire.

Unsuitable Extinguishing Media: Do not use a heavy water stream. Use of heavy stream of water may spread fire.

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5.2. Special Hazards Arising From the Substance or Mixture

Fire Hazard: Not considered flammable but may burn at high temperatures. Dust explosion hazard in air.

Explosion Hazard: Avoid dust clouds in combination with static electricity. Dust explosion hazard in air. **Reactivity:** Hazardous reactions will not occur under normal conditions. Dust clouds can be explosive.

5.3. Advice for Firefighters

Precautionary Measures Fire: Exercise caution when fighting any chemical fire.

Firefighting Instructions: Use water spray or fog for cooling exposed containers. In case of major fire and large quantities: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection During Firefighting: Do not enter fire area without proper protective equipment, including respiratory protection. **Other information:** Risk of dust explosion. Do not allow the product to be released into the environment. Do not allow run-off from fire fighting to enter drains or water courses.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal Precautions, Protective Equipment and Emergency Procedures

General Measures: Use special care to avoid static electric charges. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Handle in accordance with good industrial hygiene and safety practice. Do not breathe dust. Avoid generating dust. Avoid all contact with skin, eyes, or clothing.

6.1.1. For Non-emergency Personnel

Protective Equipment: Use appropriate personal protection equipment (PPE).

Emergency Procedures: Evacuate unnecessary personnel.

6.1.2. For Emergency Responders

Protective Equipment: Equip cleanup crew with proper protection. Use appropriate personal protection equipment (PPE). **Emergency Procedures:** Ventilate area.

6.2. Environmental Precautions

Prevent entry to sewers and public waters. Do not allow to enter drains or water courses.

6.3. Methods and Material for Containment and Cleaning Up

For Containment: Avoid generation of dust during clean-up of spills. Use only non-sparking tools.

Methods for Cleaning Up: Clear up spills immediately and dispose of waste safely. Avoid generation of dust during clean-up of spills. Use only non-sparking tools. Use explosion proof vacuum during cleanup, with appropriate filter, do not mix with other materials. Contact competent authorities after a spill.

6.4. Reference to Other Sections

See heading 8, Exposure Controls and Personal Protection.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for Safe Handling

Additional Hazards When Processed: Avoid dust production. Accumulation and dispersion of dust with an ignition source can cause a combustible dust explosion, keep dust levels to a minimum and follow applicable regulations. Do not pressurize, cut, or weld containers. . On burning: release of harmful/irritant gases/vapours e.g.: (antimony oxides).

Precautions for Safe Handling: Use only non-sparking tools. Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Handle in accordance with good industrial hygiene and safety procedures.

Hygiene Measures: Handle in accordance with good industrial hygiene and safety procedures. Wash hands and other exposed areas with mild soap and water before eating, drinking, or smoking and again when leaving work. Do no eat, drink or smoke when using this product.

7.2. Conditions for Safe Storage, Including Any Incompatibilities

Technical Measures: Proper grounding procedures to avoid static electricity should be followed. Ground/bond container and receiving equipment. Use explosion-proof electrical, ventilating, and lighting equipment. Comply with applicable regulations. **Storage Conditions:** Store in a dry, cool and well-ventilated place. Keep container closed when not in use. Keep/Store away from extremely high or low temperatures, ignition sources, incompatible materials.

Incompatible Products: Strong acids. Strong bases. Strong oxidizers.

7.3. Specific End Use(s)

No additional information available

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control Parameters

Antimony (7440-36-0)			
USA ACGIH	ACGIH TWA (mg/m ³)	0.5 mg/m³	
USA NIOSH	NIOSH REL (TWA) (mg/m³)	0.5 mg/m³	

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USA IDLH	US IDLH (mg/m ³)	50 mg/m ³
USA OSHA	OSHA PEL (TWA) (mg/m³)	0.5 mg/m ³

8.2.	Exposure Controls	
Approp	riate Engineering Controls	 Ensure all national/local regulations are observed. Proper grounding procedures to avoid static electricity should be followed. Use explosion-proof equipment. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure. Ensure adequate ventilation, especially in confined areas.
Persona	al Protective Equipment	: Gloves. Protective goggles. Respiratory protection of the dependent type. Protective clothing.
Materia	als for Protective Clothing	: Chemically resistant materials and fabrics.
Hand P	rotection	: Wear chemically resistant protective gloves.
Eye Pro	tection	: Chemical goggles or safety glasses.
Skin an	d Body Protection	: Wear suitable protective clothing.
Respira	tory Protection	: Use NIOSH-approved air-purifying or supplied-air respirator where airborne concentrations of dust are expected to exceed exposure limits.

: Wear suitable protective clothing.

Thermal Hazard Protection

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on Basic Physical and Chemical Properties			
Physical State	: Solid		
Odor	: No data available		
Odor Threshold	: No data available		
рН	: No data available		
Relative Evaporation Rate (butylacetate=1)	: No data available		
Melting Point	: No data available		
Freezing Point	: No data available		
Boiling Point	: No data available		
Flash Point	: No data available		
Auto-ignition Temperature	: No data available		
Decomposition Temperature	: No data available		
Flammability (solid, gas)	: No data available		
Vapor Pressure	: No data available		
Relative Vapor Density at 20 °C	: No data available		
Relative Density	: No data available		
Specific Gravity	: No data available		
Solubility	: No data available		
Log Pow	: No data available		
Log Kow	: No data available		
Viscosity, Kinematic	: No data available		
Viscosity, Dynamic	: No data available		
Explosive Properties	: No data available		
Oxidizing Properties	: No data available		
Explosive Limits	: No data available		

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9.2. Other Information No additional information available

SECTION 10: STABILITY AND REACTIVITY

Reactivity: Hazardous reactions will not occur under normal conditions. Dust clouds can be explosive. 10.1

10.2 **Chemical Stability:** Dust clouds can be explosive.

Possibility of Hazardous Reactions: Hazardous polymerization will not occur. 10.3

10.4 Conditions to Avoid: Direct sunlight. Extremely high or low temperatures. Open flame. Ignition sources. Incompatible materials.

10.5 Incompatible Materials: Strong acids. Strong bases. Strong oxidizers. Halogenated compounds.

Hazardous Decomposition Products: Antimony and its oxides. Metal oxides. Inhalation of fumes may cause metal fume 10.6 fever.

SECTION 11: TOXICOLOGICAL INFORMATION

Information On Toxicological Effects 11.1.

Acute Toxicity: Toxic if swallowed. Harmful if inhaled.

Antimony	
ATE (Oral)	500.000 mg/kg body weight
ATE (Dust/Mist)	1.500 mg/l/4h
Antimony (7440-36-0)	
LD50 Oral Rat	100 mg/kg
ATE (Oral)	100.000 mg/kg body weight

Skin Corrosion/Irritation: Not classified

Serious Eye Damage/Irritation: Not classified

Respiratory or Skin Sensitization: Not classified

Germ Cell Mutagenicity: Not classified

Carcinogenicity: Suspected of causing cancer.

Reproductive Toxicity: Not classified

Specific Target Organ Toxicity (Single Exposure): Not classified

Specific Target Organ Toxicity (Repeated Exposure): Not classified

Aspiration Hazard: Not classified

Symptoms/Injuries After Inhalation: Harmful if inhaled. Respiratory tract irritation.

Symptoms/Injuries After Skin Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Eye Contact: Prolonged contact with large amounts of dust may cause mechanical irritation.

Symptoms/Injuries After Ingestion: Toxic if swallowed. May cause nausea, vomiting, and diarrhea.

Chronic Symptoms: Prolonged exposure may cause effects in specific organs such as the liver, kidneys, blood, and nervous system.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity **Ecology - General**

: Toxic to aquatic life with long lasting effects.

May cause long-term adverse effects in the environment.

Persistence and Degradability 12.2.

Antimony

Persistence and Degradability

12.3. **Bioaccumulative Potential** No additional information available

- 12.4. Mobility in Soil No additional information available
- 12.5. **Other Adverse Effects**

Other Information

: Avoid release to the environment. SECTION 13: DISPOSAL CONSIDERATIONS

Waste treatment methods 13.1.

Waste Disposal Recommendations: Dispose of waste material in accordance with all local, regional, national, and international regulations.

Additional Information: The materials contained within this product are hazardous to the environment, do not release into the environment.

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SECTION 14: TRANSPORT INFORMATION

14.1 In Accordance with DOT		
Proper Shipping Name	:	ANTIMONY POWDER
Hazard Class	:	6.1
Identification Number	:	UN2871
Label Codes	:	6.1
Packing Group	:	III
Marine Pollutant	:	Marine pollutant
ERG Number	:	170
14.2 In Accordance with IMDO	G	
Proper Shipping Name	:	ANTIMONY POWDER
Hazard Class	:	6.1
Identification Number	:	UN2871
Packing Group	:	III
Label Codes	:	6.1
EmS-No. (Fire)	:	F-A
EmS-No. (Spillage)	:	S-A
MFAG Number	:	171
14.3 In Accordance with IATA		
Proper Shipping Name	:	ANTIMONY POWDER
Packing Group	:	III
Identification Number	:	UN2871
Hazard Class	:	6
Label Codes	:	6.1
ERG Code (IATA)	:	6L

SECTION 15: REGULATORY INFORMATION

15.1	US	Federal	Regulations
A			

Antimony	
SARA Section 311/312 Hazard Classes	Delayed (chronic) health hazard
	Immediate (acute) health hazard
Antimony (7440-36-0)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory	

1.0 %

Listed on SARA Section 313 (Specific toxic chemical listings) SARA Section 313 - Emission Reporting

15.2 US State Regulations

Antimony (7440-36-0)

U.S California - Priority Toxic Pollutants - Human Health Criteria
U.S California - Toxic Air Contaminant List (AB 1807, AB 2728)
U.S Colorado - Primary Drinking Water Regulations - Maximum Contaminant Level Goals (MCLGs)
U.S Colorado - Primary Drinking Water Regulations - Maximum Contaminant Levels (MCLs)
U.S Connecticut - Drinking Water Quality Standards - Maximum Contaminant Levels
U.S Connecticut - Hazardous Air Pollutants - HLVs (30 min)
U.S Connecticut - Hazardous Air Pollutants - HLVs (8 hr)
U.S Connecticut - Water Quality Standards - Consumption of Organisms Only
U.S Connecticut - Water Quality Standards - Consumption of Water and Organisms
U.S Connecticut - Water Quality Standards - Health Designations
U.S Delaware - Pollutant Discharge Requirements - Reportable Quantities
U.S Florida - Drinking Water Standards - Inorganic Contaminants - Maximum Contaminant Levels (MCLs)
U.S Georgia - Drinking Water - Maximum Contaminant Levels (MCLs)
U.S Idaho - Non-Carcinogenic Toxic Air Pollutants - Acceptable Ambient Concentrations
U.S Idaho - Non-Carcinogenic Toxic Air Pollutants - Emission Levels (ELs)
U.S Idaho - Occupational Exposure Limits - TWAs

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U.S. - Illinois - Toxic Air Contaminants U.S. - Louisiana - Reportable Quantity List for Pollutants U.S. - Maine - Air Pollutants - Hazardous Air Pollutants U.S. - Maryland - Surface Water Quality Standards - Consumption of Organisms Only U.S. - Maryland - Surface Water Quality Standards - Consumption of Water and Organisms U.S. - Massachusetts - Allowable Ambient Limits (AALs) U.S. - Massachusetts - Allowable Threshold Concentrations (ATCs) U.S. - Massachusetts - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 1 U.S. - Massachusetts - Oil & Hazardous Material List - Groundwater Reportable Concentration - Reporting Category 2 U.S. - Massachusetts - Oil & Hazardous Material List - Reportable Quantity U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 1 U.S. - Massachusetts - Oil & Hazardous Material List - Soil Reportable Concentration - Reporting Category 2 U.S. - Massachusetts - Right To Know List U.S. - Massachusetts - Threshold Effects Exposure Limits (TELs) U.S. - Massachusetts - Toxics Use Reduction Act U.S. - Michigan - Occupational Exposure Limits - TWAs U.S. - Michigan - Polluting Materials List U.S. - Minnesota - Chemicals of High Concern U.S. - Minnesota - Groundwater Health Risk Limits U.S. - Minnesota - Hazardous Substance List U.S. - Minnesota - Permissible Exposure Limits - TWAs U.S. - Missouri - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - Nebraska - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - New Hampshire - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - 24-Hour U.S. - New Hampshire - Regulated Toxic Air Pollutants - Ambient Air Levels (AALs) - Annual U.S. - New Jersey - Discharge Prevention - List of Hazardous Substances U.S. - New Jersey - Environmental Hazardous Substances List U.S. - New Jersey - Primary Drinking Water Standards - Maximum Contaminant Levels - MCLs U.S. - New Jersey - Right to Know Hazardous Substance List U.S. - New Jersey - Water Quality - Ground Water Quality Criteria U.S. - New Jersey - Water Quality - Practical Quantitation Levels (PQLs) U.S. - New York - Occupational Exposure Limits - TWAs U.S. - New York - Reporting of Releases Part 597 - List of Hazardous Substances U.S. - North Dakota - Air Pollutants - Guideline Concentrations - 8-Hour U.S. - North Dakota - Water Quality Standards - Human Health Value for Class III U.S. - North Dakota - Water Quality Standards - Human Health Value for Classes I, IA, II U.S. - Oregon - Permissible Exposure Limits - TWAs U.S. - Pennsylvania - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S. - Pennsylvania - RTK (Right to Know) List U.S. - Rhode Island - Air Toxics - Acceptable Ambient Levels - 24-Hour U.S. - Rhode Island - Water Quality Standards - Acute Freshwater Aquatic Life Criteria U.S. - Rhode Island - Water Quality Standards - Chronic Freshwater Aquatic Life Criteria U.S. - Rhode Island - Water Quality Standards - Human Health Criteria for Consumption of Aquatic Organisms Only U.S. - Rhode Island - Water Quality Standards - Human Health Criteria for Consumption of Water and Aquatic Organisms U.S. - South Carolina - Maximum Contaminant Levels (MCLs) U.S. - Tennessee - Occupational Exposure Limits - TWAs U.S. - Texas - Drinking Water Standards - Maximum Contaminant Levels (MCLs) U.S. - Texas - Effects Screening Levels - Long Term U.S. - Texas - Effects Screening Levels - Short Term U.S. - Utah - Drinking Water - Maximum Contaminant Levels (MCLs) U.S. - Vermont - Hazardous Waste - Hazardous Constituents U.S. - Vermont - Permissible Exposure Limits - TWAs U.S. - Virginia - Water Quality Standards - Public Water Supply Effluent Limits U.S. - Virginia - Water Quality Standards - Surface Waters Not Used for the Public Water Supply Effluent Limits

Safety Data Sheet according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

U.S. - Washington - Dangerous Waste - Dangerous Waste Constituents List

U.S. - Washington - Permissible Exposure Limits - STELs

U.S. - Washington - Permissible Exposure Limits - TWAs

U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 25 Feet to Less Than 40 Feet

U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 40 Feet to Less Than 75 Feet

U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights 75 Feet or Greater U.S. - Wisconsin - Hazardous Air Contaminants - All Sources - Emissions From Stack Heights Less Than 25 Feet

SECTION 16: OTHER INFORMATION

: 02/12/2014

Revision date Other Information

: This document has been prepared in accordance with the SDS requirements of the OSHA Hazard Communication Standard 29 CFR 1910.1200.

GHS Full Text Phrases:

Acute Tox. 3 (Oral)	Acute toxicity (oral) Category 3	
Acute Tox. 4 (Inhalation)	Acute toxicity (inhalation) Category 4	
Acute Tox. 4 (Inhalation:dust,mist)	Acute toxicity (inhalation:dust,mist) Category 4	
Aquatic Acute 2	Hazardous to the aquatic environment - Acute Hazard Category 2	
Aquatic Chronic 2	Hazardous to the aquatic environment - Chronic Hazard Category 2	
Carc. 2	Carcinogenicity Category 2	
Comb. Dust	Combustible Dust	
	May form combustible dust concentrations in air	
H301	Toxic if swallowed	
H332	Harmful if inhaled	
H351	Suspected of causing cancer	
H401	Toxic to aquatic life	
H411	Toxic to aquatic life with long lasting effects	

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

SDS US (GHS HazCom) - US

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.2 Revision Date 02/27/2015 Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Aroclor 1254	
	Product Number Brand Index-No.	:	48586 Supelco 602-039-00-4	
	CAS-No.	:	11097-69-1	
1.2	Relevant identified uses of the substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Manufacture of substances	
1.3	Details of the supplier of	the	safety data sheet	
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052	
1.4	Emergency telephone nu	mbe	r	

1.4 Emergency telephone numbe

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Specific target organ toxicity - repeated exposure (Category 2), H373 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Warning

Hazard statement(s)	
H302	Harmful if swallowed.
H373	May cause damage to organs through prolonged or repeated exposure.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.

P314	Get medical advice/ attention if you feel unwell.
P391	Collect spillage.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

CAS-No.	:	11097-69-1
Index-No.	:	602-039-00-4

Hazardous components

Component	Classification	Concentration
Aroclor 1254		
	Acute Tox. 4; STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H302, H373, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Nature of decomposition products not known.

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Aroclor 1254	11097-69-1	TWA	0.5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	Skin designa	ition	
		TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Skin designa	ition	
		TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respi	ratory Tract irritatio	on la
		Liver damage	е	
		Chloracne		
		Confirmed a	nimal carcinogen v	vith unknown relevance to humans
		Danger of cu	taneous absorptio	n
		TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respi Liver damag Chloracne Confirmed au Danger of cu	ratory Tract irritatic e nimal carcinogen v itaneous absorptio	vith unknown relevance to humans n
		TWA	0.5 mg/m3	USA. OSHA - TABLE Z-1 Limits for
			-	Air Contaminants - 1910.1000
		Skin notation	1	
		TWA	0.001000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Potential Oc	cupational Carcino	gen
		See Append	ix A	

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition	No data available

temperature

- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available
- 9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 1,010 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

Rat Liver Unscheduled DNA synthesis

Rat Liver DNA damage

Mouse fibroblast Morphological transformation.

Rat Morphological transformation. Rat DNA damage

Rat DNA damage

Carcinogenicity

Carcinogenicity - Rat - Oral Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors.

Carcinogenicity - Rat - Oral Tumorigenic:Carcinogenic by RTECS criteria. Liver:Tumors.

Carcinogenicity - Mouse - Skin

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Skin and Appendages: Other: Tumors. Tumorigenic:Tumors at site or application.

Carcinogenicity - Rat - Oral

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Gastrointestinal:Tumors.

Carcinogenicity - Mouse - Oral Tumorigenic:Neoplastic by RTECS criteria. Liver:Tumors.

Carcinogenicity - Mouse - Intraperitoneal

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic Effects: Uterine tumors. Lungs, Thorax, or Respiration:Tumors.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Reproductive toxicity - Rabbit - Oral Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants). Effects on Fertility: Abortion. Effects on Embryo or Fetus: Fetal death.

Reproductive toxicity - Rabbit - Oral Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Rat - Oral Effects on Newborn: Behavioral.

Reproductive toxicity - Rat - Oral Effects on Newborn: Delayed effects.

Reproductive toxicity - Rat - Intraperitoneal Maternal Effects: Other effects. Effects on Newborn: Biochemical and metabolic.

Reproductive toxicity - Mouse - Oral Effects on Newborn: Behavioral.

Reproductive toxicity - Mammal - Oral Effects on Fertility: Female fertility index (e.g., # females pregnant per # sperm positive females; # females pregnant per # females mated).

No data available

Developmental Toxicity - Rat - Oral

Specific Developmental Abnormalities: Hepatobiliary system.

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

Additional Information

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Oncorhynchus mykiss (rainbow trout) - 0.22 µg/l - 96.0 h

Toxicity to algae LC50 - Algae - 0.015 mg/l - 28 h

12.2 Persistence and degradability

12.3 Bioaccumulative potential

Bioaccumulation Pimephales promelas (fathead minnow) - 8 Months - 1.8 µg/l

Bioconcentration factor (BCF): 238,000

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2315 Class: 9 Packing group: II Proper shipping name: Polychlorinated biphenyls, liquid Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 2315 Class: 9

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

······································	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Aroclor 1254	11097-69-1	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Aroclor 1254	11097-69-1	1990-06-30
WARNING: This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause birth defects or other reproductive harm.	11097-69-1	1990-06-30
Aroclor 1254		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity			
Aquatic Acute Acute aquatic toxicity				
Aquatic Chronic	Chronic aquatic toxicity			
H302	Harmful if swallowed.			
H373	May cause damage to organs through prolonged or repeated exposure.			
H400	Very toxic to aquatic life.			
H410	Very toxic to aquatic life with long lasting effects.			
STOT RE	Specific target organ toxicity - repeated exposure			
HMIS Rating				
Health hazard:	1			
Chronic Health Haza	ard: *			
Flammability:	0			
Physical Hazard	0			
NFPA Rating				
Health hazard:	1			
Fire Hazard:	0			
Reactivity Hazard:	0			

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.2

Revision Date: 02/27/2015

Print Date: 05/01/2016

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.3 Revision Date 06/25/2015 Print Date 05/11/2016

1. PR	1. PRODUCT AND COMPANY IDENTIFICATION			
1.1	Product identifiers Product name	:	AROCLOR 1260	
	Product Number Brand	:	CRM48736 Supelco	
1.2	Relevant identified uses of	of th	e substance or mixture and uses advised against	
	Identified uses	:	Laboratory chemicals, Manufacture of substances	
1.3	Details of the supplier of the safety data sheet			
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052	
1.4	Emergency telephone nur	nbe	r	
	Emergency Phone #	:	(314) 776-6555	
2. HA	2. HAZARDS IDENTIFICATION			

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS) Carcinogenicity (Category 1B), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Danger
May cause cancer.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
IF exposed or concerned: Get medical advice/ attention.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Hazardous components

Component		Classification	Concentration
Distillates (petroleum), h	ydrotreated middle		
CAS-No.64742-46-7EC-No.265-148-2Index-No.649-221-00-X		Carc. 1B; H350	>= 90 - <= 100 %
Baseoil - unspecified			
CAS-No. EC-No. Index-No.	64742-53-6 265-156-6 649-466-00-2	Carc. 1B; H350	>= 30 - < 50 %
2,6-di-tert-Butyl-p-creso	I		
CAS-No. EC-No.	128-37-0 204-881-4	Aquatic Acute 1; Aquatic Chronic 1; H410	>= 0.1 - < 1 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Nature of decomposition products not known.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
 Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
 For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Distillates (petroleum), hydrotreated middle	64742-46-7	TWA	500.000000 ppm 2,000.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	The value in mg/m3 is approximate.		

		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	5 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	5 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10 mg/m3	USA. NIOSH Recommended Exposure Limits
Baseoil - unspecified	64742-53-6	TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	5.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respi Not classifial	ratory Tract irritation ble as a human ca	on rcinogen
		TWA	5.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	10.000000 mg/m3	USA. NIOSH Recommended Exposure Limits

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid		
b)	Odour	No data available		
c)	Odour Threshold	No data available		
d)	рН	No data available		
e)	Melting point/freezing point	No data available		
f)	Initial boiling point and boiling range	No data available		
g)	Flash point	No data available		
h)	Evaporation rate	No data available		
i)	Flammability (solid, gas)	No data available		
j)	Upper/lower flammability or explosive limits	No data available		
k)	Vapour pressure	No data available		
I)	Vapour density	No data available		
m)	Relative density	No data available		
n)	Water solubility	No data available		
0)	Partition coefficient: n- octanol/water	No data available		
p)	Auto-ignition temperature	No data available		
q)	Decomposition temperature	No data available		
r)	Viscosity	No data available		
s)	Explosive properties	No data available		
t)	Oxidizing properties	No data available		
Other safety information No data available				

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

- No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: 3 Group 3: Not classifiable as to its carcinogenicity to humans (2,6-di-tert-Butyl-p-cresol)
- IARC: 3 Group 3: Not classifiable as to its carcinogenicity to humans (Distillates (petroleum), hydrotreated middle)
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available No data available

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Nerves. - (Aroclor 1260)

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

Not dangerous goods

IMDG Not dangerous goods

ΙΑΤΑ

Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

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SARA 311/312 Hazards

Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-NO.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24
New Jersey Right To Know Components		
, , ,	CAS-No.	Revision Date
Distillates (petroleum), hydrotreated middle	64742-46-7	1989-08-11
Baseoil - unspecified	64742-53-6	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Aroclor 1260	11096-82-5	2008-08-01
Distillates (petroleum), hydrotreated middle	64742-46-7	2013-12-20
WARNING: This product contains a chemical known to the	CAS-No.	Revision Date

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.3

Revision Date: 06/25/2015

Print Date: 05/11/2016

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SAFETY DATA SHEET

Version 5.3 Revision Date 02/27/2015 Print Date 05/11/2016

1. PR	1. PRODUCT AND COMPANY IDENTIFICATION					
1.1	Product identifiers Product name	:	Aroclor 1268 solution			
	Product Number Brand	:	502146 Supelco			
1.2	Relevant identified uses o	f th	e substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Manufacture of substances			
1.3	Details of the supplier of t	he s	safety data sheet			
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA			
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052			
1.4	Emergency telephone nun	nbe	r			
	Emergency Phone #	:	(314) 776-6555			
0 11 4						

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Skin irritation (Category 2), H315 Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336 Aspiration hazard (Category 1), H304 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.

P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P403 + P233 P403 + P235 P405	Store in a well-ventilated place. Keep container tightly closed. Store in a well-ventilated place. Keep cool. Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Hazardous components

Component		Classification	Concentration
2,2,4-Trimethylpentane			
CAS-No. EC-No. Index-No.	540-84-1 208-759-1 601-009-00-8	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410	>= 90 - <= 100 %
PCB- Aroclor 1268			
CAS-No.	11100-14-4	STOT RE 2; Aquatic Acute 1; Aquatic Chronic 1; H373, H410	>= 0.1 - < 1 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
2,2,4-	540-84-1	TWA	300.000000	USA. ACGIH Threshold Limit Values
Trimethylpentane			ppm	(TLV)
	Remarks	Upper Respiratory Tract irritation		
PCB- Aroclor 1268	11100-14-4	TWA	0.001000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Potential Occupational Carcinogen		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	-116 °C (-177 °F)
f)	Initial boiling point and boiling range	99 °C (210 °F) at 1,013 hPa (760 mmHg)
g)	Flash point	-12 °C (10 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6 %(V) Lower explosion limit: 1.1 %(V)
k)	Vapour pressure	55 hPa (41 mmHg)
I)	Vapour density	3.9
----	--	-------------------
m)	Relative density	0.690 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Ot	her safety information	
	Relative vapour density	3.9

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

10.2 Chemical stability Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks.

10.5 Incompatible materials Strong oxidizing agents

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

Carcinogenicity

This product is or contains a component that has been reported to be probably carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

Additional Information

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Liver - Irregularities - Based on Human Evidence Liver - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence (PCB- Aroclor 1268)

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1262 Class: 3 Proper shipping name: Octanes, solution Reportable Quantity (RQ): 1000 lbs Packing group: II

Poison Inhalation Hazard: No

IMDG

UN number: 1262	Class: 3	Packing group: II	EMS-No: F-E, S-E
Proper shipping name:	OCTANES, SOLUTION		
Marine pollutant:yes			
IATA			
UN number: 1262	Class: 3	Packing group: II	
Proper shipping name:	Octanes, solution	`	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

3 1 1 1	CAS-No.	Revision Date
2,2,4-Trimethylpentane	540-84-1	2007-03-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
2,2,4-Trimethylpentane	540-84-1	2007-03-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
2,2,4-Trimethylpentane	540-84-1	2007-03-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

State of California to cause cancer. PCB- Aroclor 1268	11100-14-4	2008-08-01
WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive	CAS-No. 11100-14-4	Revision Date 2008-08-01

harm.

PCB- Aroclor 1268

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Chronic Chronic aquatic toxicity	
Asp. Tox. Aspiration hazard	
Flam. Liq. Flammable liquids	
H225 Highly flammable liquid and vapour.	
H304 May be fatal if swallowed and enters airways.	
H315 Causes skin irritation.	
H336 May cause drowsiness or dizziness.	
H373 May cause damage to organs through prolonged or repeated expos	sure.
H400 Very toxic to aquatic life.	
H410 Very toxic to aquatic life with long lasting effects.	
Skin Irrit. Skin irritation	
STOT RE Specific target organ toxicity - repeated exposure	
STOT SE Specific target organ toxicity - single exposure	

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0
NFPA Rating	
NFPA Rating Health hazard:	2
NFPA Rating Health hazard: Fire Hazard:	2 3

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.3

Revision Date: 02/27/2015

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Division of Facilities Services

DOD Hazardous Material Information (ANSI Format) For Cornell University Convenience Only

ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

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Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Product Identification: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE Date of MSDS: 08/01/1997 Technical Review Date: 09/01/1999 FSC: 6810 NIIN: LIIN: 00N092040 Submitter: N NF Status Code: A MFN: 01 Article: N Kit Part: N Manufacturer's Name: UNITED MINERAL & CHEMICAL CORP Manufacturer's Address1: 1100 VALLEYBROOK AVE Manufacturer's Address2: LYNDHURST, NJ 07071 Manufacturer's Country: US General Information Telephone: 201-507-3300 Emergency Telephone: (800)424-9300 Emergency Telephone: (800)424-9300 Chemtec Telephone: (800)424-9300 Proprietary: N Reviewed: Y Published: Y CAGE: 87730

Contractor Information

Contractor's Name: UNITED MINERAL & CHEMICAL CORP **Contractor's Address1:** 1100 VALLEYBROOK AVE **Contractor's Address2:** LYNDHURST, NJ 07071 **Contractor's Telephone:** 201-507-3300 **Contractor's CAGE:** 87730

Section 2 - Compositon/Information on Ingredients ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Ingredient Name: ARSENIC; (ARSENIC METAL) Ingredient CAS Number: 7440-38-2 Ingredient CAS Code: T RTECS Number: CG0525000 RTECS Code: T **=WT:** 100. **=WT Code:** M =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: % Enviromental Weight: **Other REC Limits: N/P OSHA PEL: N/P OSHA PEL Code: OSHA STEL: N/P OSHA STEL Code:** ACGIH TLV: 0.01 MG/M3 ACGIH TLV Code: T ACGIH STEL: NOT ESTABLISHED ACGIH STEL Code: T **EPA Reporting Quantity:** 1 LB **DOT Reporting Quantity:** 1 LB **Ozone Depleting Chemical:** N

> Section 3 - Hazards Identification, Including Emergency Overview ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Health Hazards Acute & Chronic: ARSENIC METAL IS NOT AS READILY AVAIL IN THE BODY AS ARSENIC IN THE FORM OF DUST OR VAP OR WHEN PROCESSED INTO ARSENIC CMPDS (ARSENICALS). INORGANIC ARSENICALS ARE MORE TOXIC THAN ORGANIC ARSENICALS. ACUTE EFTS: ARSENIC IS POISON BY SUBCUTANEOUS, INTRAMUSCULAR & INTRAPERITONEAL ROUTES. ACUTE ARSENIC POISONING FROM INGEST RSLTS IN MARKED IRRIT OF STOMACH & INTESTINES W/NAUS, VOMIT & DIARR. IN SEV C ASES STOOLS & VOMIT ARE BLOODY & PATIENT MAY GO INTO COLLAPSE & SHOCK W/WEAK, RAPID PULSE, COLD SWEATS, COMA & DEATH. INHAL MAY CAUSE ULCERATION OF NASAL SEPTUM, RESP IRRIT. SKIN/EYE CNTCT MAY CAUSE DERM, SKIN & EYE (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:

HLTH HAZS: IRRIT. CHRONIC EFTS: ARSENIC IS CONFIRMED HUMAN CARCIN PRODUCING LIVER TUMORS & AN EXPERIMENTAL TERATOGEN (MAY CAUSE DMG TO DEVELOPING FETUS). CHRONIC ARSENIC POISONING MAY INCL ANY/ALL OF FOLLOWING: DIGEST SYS DISTURBS, LOSS OFAPPETITE, CRAMPS, NAUS, CONSTIP, DIARR; LIVER DMG WHICH MAY RSLT IN JAUN; DISTURBS OF BLOOD, KIDNEYS & NERVOUS SYS; SKIN ABNORMS INCL ITCHING, PIGMENTATION & POS S CANCEROUS CHGS. TARGET ORGANS FOR INORGANIC CMPDS AS AS): LIVER, KIDNEYS, SKIN, LUNGS, LYMPHATIC SYS. TLV: 0.01 MG/M3 TWA ARSENIC, ELEMENTAL & INORGANIC CMPDS (EXCEPT ARSINE), AS AS. OSHA PEL: (SUPD AT)

Medical Conditions Aggravated by Exposure:

KNOWN EFFECTS ON OTHER ILLNESSES: GASTROINTESTINAL. NERVOUS SYSTEM. SKIN. LIVER & KIDNEY PROBLEMS. AFTER EXPOSURE HAVE URINE TEST.

LD50 LC50 Mixture: LD50: (ORAL, RAT) 763 MG/M3

Route of Entry Indicators:

Inhalation: YES Skin: YES Ingestion: YES

Carcenogenicity Indicators

NTP: YES IARC: YES OSHA: YES

Carcinogenicity Explanation: ARSENIC: IARC MONOGRAPHS, SUPPLEMENT, VOL 7, PG 100, 1987: GROUP 1. NTP 8TH ANNUAL REPORT ON CARCINOGENS, 1998: KNOWN TO BE CARCINOGEN. OSHA REGULATED: CFR 29 1910.1018.

Section 4 - First Aid Measures ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

First Aid:

SKIN: FLUSH WITH SOAP AND WATER. AVOID RUBBING INTO SKIN. CONTACT MD IMMEDIATELY. EYES: FLUSH WITH WATER FOR AT LEAST 15 MINUTES. CONTACT PHYSICIAN IMMEDIATELY. INHALATION: REMOVE TO FRESH AIR. PROVID E OXYGEN IF NECESSARY. CONTACT PHYSICIAN IMMEDIATELY. INGESTION: TREATMENT WITH BAS(DIMERCAPTOL) IS OF QUESTIONABLE EFFECTIVENESS IN TRIVALENT ARSENIC COMPOUNDS. INDUCE VOMITING AND DO GASTRIC LAVAGE. GET PERSONNEL TO HOSPITAL IMMEDIATELY. A PHYSICIAN CAN INITIATE AN EXCHANGE TRANSFUSION AND DIALYSIS. ALSO ABSORPTION AND REMOVAL WITH ANIMAL BONE COAL OR FE(OH)*2 SHOULD BE DONE.

Section 5 - Fire Fighting Measures ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Fire Fighting Procedures:

USE NIOSH APPRVD SCBA & FULL PROT EQUIP (FP N). RESTRICT PERS NOT WEARING PROT EQUIP FROM AREA. TRY TO SNUFF FIRE W/SAND, DRY MEDIA, FOAM OR CO*2. IF NO OTHER OPTIONS AVAILABLE, USE WATER & ALWAYS WEA R NIOSH APPRVD SCBA OR NIOSH TOXIC VAPOR RESP. POISONOUS GASES ARE PRODUCED IN FIRE, INCLUDING ARSENIC OXIDES.

Unusual Fire or Explosion Hazard:

ARSENIC, WHEN HEATED OR IN CONTACT W/ACID OR ACID FUMES, CAN PRODUCE HIGHLY TOXIC FUMES. ARSENIC REACTS VIGOROUSLY W/OXIDIZING MATLS. ARSENIC IS FLAMMABLE IN FORM OF DUST WHEN EXPOSED TO HEAT OR FLAME OR BY CHEMICAL RXN W/POWERFUL OXIDIZERS. SLIGHT EXPLOSION HAZ EXISTS IN FORM OF DUST WHEN EXPOSED TO (ECOLOGICAL INFO) **Extinguishing Media:** FOAM, CARBON DIOXIDE, DRY CHEMICAL.

Flash Point: Flash Point Text: NONE

Autoignition Temperature:

Autoignition Temperature Text: N/K Lower Limit(s): N/A Upper Limit(s): N/A

Section 6 - Accidental Release Measures ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Spill Release Procedures:

RESTRICT PERSONS NOT WEARING PROTECTIVE EQUIPMENT FROM AREA UNTIL CLEANUP IS COMPLETE. WEARING NIOSH APPROVED RESPIRATOR, GLOVES, GOGGLES, LAB COAT, GATHER UP CHUNKS, RODS OR GRANULES WITH VACUUM OR U TENSILS RESERVED FOR POISONOUS SOLIDS. AVOID RAISING DUST. VENTILATE THE AREA AFTER CLEANUP IS COMPLETE.

> Section 7 - Handling and Storage ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Repiratory Protection:

NIOSH APPROVED, AIR PURIFYING, TOXIC VAPOR RESPIRATOR TO PARTICULATE AND FUME AIR LEVEL. FOR INORGANIC ARSENIC APPLICATIONS, SEE 29 CFR 1910.1018 FOR PROPER RESPIRATOR SELECTION.

Ventilation:

LOC EXHST/MECH (GEN) SCRUBBER OR TRAP IF POSS TO MAINTAIN EXPOS TO LESS THAN PERMISSIBLE LIMITS FOR ELEMENTAL ARSENIC & ANY CMPDS BEING GENERATED.

Protective Gloves:
NEOPRENE OR PLASTIC.
Eye Protection: ANSI APPROVED CHEMICAL WORKERS GOGGLES (FP N).
Other Protective Equipment: ANSI APPROVED EYE WASH AND DELUGE SHOWER (FP N). LAB COAT.
Work Hygenic Practices: N/P
Supplemental Health & Safety Information: EFTS OF OVEREXP: 0.01 MG/M3 AS AS & INORGANIC CMPDS; 0.5 AS AS ORGANIC CMPDS. ACGIH TLV: 0.01 MG/M3 TWA ARSENIC, ELEMENTAL & INORGANIC CMPDS (EXCEPT ARSINE), AS AS. ALSO SEE TOXICOLOGICAL INFO. WASTE DISP METH: HAZ DEPENDING ON LEVEL OF TOX CHARACT OF ARSENIC. SEE 40 CFR 261.24 FOR

DETERMINATION. (OTHER INFO)

Section 9 - Physical & Chemical Properties ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

HCC:

NRC/State License Number: Net Property Weight for Ammo: Boiling Point: =612.C, 1133.6F **Boiling Point Text:** SUBLIMES Melting/Freezing Point: =814.C, ######F Melting/Freezing Text: @ 36 ATM. FP:N/A **Decomposition Point: Decomposition Text:** N/P Vapor Pressure: 1 MMHG @ 372C Vapor Density: N/A **Percent Volatile Organic Content:** Specific Gravity: 5.727 **Volatile Organic Content Pounds per Gallon:** pH: NONE-0% IN H*2O **Volatile Organic Content Grams per Liter:** Viscosity: N/P **Evaporation Weight and Reference: N/A** Solubility in Water: INSOLUBLE Appearance and Odor: SILVER GRAY CRYSTALLINE CHUNKS, RODS OR GRANULES; NO ODOR AS (ECOLOGICAL INFO) Percent Volatiles by Volume: N/A (BY WT) **Corrosion Rate:** N/P

Section 10 - Stability & Reactivity Data ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Stability Indicator: YES Materials to Avoid: INCOMPATIBLE W/BROMINE AZIDE, DIRUBIDIUM ACETYLIDE, HALOGENS, PALLADIUM ZINC, PLATINUM, NCL*3, AGNO*3, CRO*3, NA*2O*2, HEXAFLUOROISOPROPYLIDENEAMINO LITHIUM. CAN REACT W/ACIDS OR ACID FUMES & POWERFUL OXIDIZERS SUCH AS BROM Stability Condition to Avoid: AVOID OPEN CONTAINERS AND CONTACT WITH INCOMPATIBLE MATERIALS. Hazardous Decomposition Products: ARSENIC FUMES, ARSINE, OTHER ARSENIC COMPOUNDS. Hazardous Polymerization Indicator: NO Conditions to Avoid Polymerization: N/P

ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Toxicological Information: LD50: TDLO 605 ?G/KG. ORAL-MAN TDLO 7857 MG/KG/55Y SKIN. DERMAL IRRITATION-RABBIT: UNKNOWN; SUBCUTANEOUS IMPLANT RABBIT LTLO 75 MG/KG. EYE IRRITATION-RABBIT: UNKNOWN.

Section 12 - Ecological Information ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Ecological Information:

N/P. EXPLO HAZ: FLAME. IN EVENT OF A FIRE OR SPILL CONTACT THE STATE DEPARTMENT OF THE ENVIRONMENT & YOUR REGIONAL OFFICE OF THE FEDERAL EPA. PHYSICAL DATA -APPEAR/ODOR: METAL AS COMPOUND, ASH*3, HAS GARLIC ODOR. ODOR THRESHOLD: N/A. MATLS TO AVOID: CHLORATES, IODATES, PEROXIDES, LITHIUM, NACL*3, KMNO*3, RB*2C*2, AGNO*4, NOCL, IF*5, CRO*3, CLF*3, CLO, BRF*3, BRF*5, BRN*3, RBC*3BCH, CSC*3BCH.

Section 13 - Disposal Considerations ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Waste Disposal Methods:

SOLID WASTES SHOULD BE VITRIFIED, PLACED IN LABELED CNTNR & BURIED IN EPA SUPERVISED FACILITY. ETCHING SOLNS & CUTTING WASTES SHOULD BE PRECIPITATED, CEMENTED/VITRIFIED & PLACED IN METAL/PLASTIC LABEL ED CNTNRS & BURIED IN EPA SUPERVISED FACILITY. PASS GAS THRU POTASSIUM PERMANGANATE, PRECIPITATE & T REAT AS ABOVE. WASTE MAY BE CONSIDERED (SUPDAT)

Section 14 - MSDS Transport Information ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Transport Information:

DOT REGULATED: YES. RQ: (NA - PIECES ARE LARGER THAN 100 MICROMETERS IN DIAMETER). IF REGULATED, PROPER SHIPPING NAME: ARSENIC. HAZARD CLASS: (6.1). IDENTIFICATION NO: (UN1558). PACKING GROUP: (III). LABEL REQUIRED: (POISON). INLAND B/L: ARSENIC, 6.1, UN1558, PACKING GROUP II, POISON. EMERGENCY RESPONSE GUIDE NO: (152).

Section 15 - Regulatory Information ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

SARA Title III Information: SARA TITLE III, SECT 313: LISTED. Federal Regulatory Information: TSCA: WE CERTIFY THAT ALL COMPONENTS OF THIS PRODUCT ARE REGISTERED UNDER THE REGULATIONS OF THE TOXIC SUBSTANCES CONTROL ACT. HMIS: HEALTH (4); FLAMMABILITY (0); REACTIVITY (1). State Regulatory Information:

Section 16 - Other Information ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE

Other Information:

WASTE DISP METH: HAZARDOUS DEPENDING ON LEVEL OF TOXICITY CHARACTERISTIC OF ARSENIC. SEE 40 CFR 261.24 FOR DETERMINATION. RCRA HAZARDOUS WASTE: YES RCRA @: D004; IF TESTED POSITIVE AS CHARACT OF TOXIC ITY FOR ARSENIC. CERCLA: YES. RQ (1 LB RQ IS APPLICABLE ONLY IF DIAMETER OF PIECES OF SOLID METAL RELEASED IS LESS THAN 100 MICROMETERS OR 0.004 INCH. THIS PROD FORM IS LARGER THAN 100 MICROMETERS & H AS NO RQ IN ITS CURRENT FORM. IF AS HAZ WASTE CHARACT OF ARSENIC, THEN RQ=1LB. FOLLOW ALL LOCAL, STATE AND FEDERAL INFO & REGULATIONS.

HAZCOM Label Information

Product Identification: ARSENIC METAL-MBE CHARGES, ARSENIC CHUNK & GRANULE **CAGE: 87730** Assigned Individual: N **Company Name: UNITED MINERAL & CHEMICAL CORP Company PO Box:** Company Street Address1: 1100 VALLEYBROOK AVE Company Street Address2: LYNDHURST, NJ 07071 US Health Emergency Telephone: (800)424-9300 Label Required Indicator: Y Date Label Reviewed: 09/01/1999 Status Code: A **Manufacturer's Label Number:** Date of Label: Year Procured: N/K **Organization Code:** F **Chronic Hazard Indicator:** Y **Eye Protection Indicator: YES Skin Protection Indicator: YES Respiratory Protection Indicator: YES** Signal Word: DANGER Health Hazard: Severe **Contact Hazard: Severe** Fire Hazard: None Reactivity Hazard: Slight

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SAFETY DATA SHEET

Version 4.5 Revision Date 03/02/2015 Print Date 05/24/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers		
	Product name	:	Barium
	Product Number	:	237094
	Brand	:	Aldrich
	CAS-No.	:	7440-39-3
1.2	Relevant identified use	s of th	e substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company		Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052	

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 2), H261 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Cineral word



Signal word	Danger
Hazard statement(s)	
H261	In contact with water releases flammable gases.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
Precautionary statement(s)	
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232	Handle under inert gas. Protect from moisture.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.

P280 P302 + P352	Wear protective gloves/ eye protection/ face protection. IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P335 + P334	Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404	Store in a dry place. Store in a closed container.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Ва
Molecular weight	:	137.33 g/mol
CAS-No.	:	7440-39-3
EC-No.	:	231-149-1

Hazardous components

Component	Classification	Concentration
Barium		
	Water-react. 2; Skin Irrit. 2; Eye Irrit. 2A; STOT SE 3; H261 H315 H319 H335	<= 100 %
	H261, H315, H319, H335	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Dry powder

- 5.2 Special hazards arising from the substance or mixture Barium oxide
- **5.3** Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.
- 5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

- 6.3 Methods and materials for containment and cleaning up Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wetbrushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.
- 6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Never allow product to get in contact with water during storage.

Store under inert gas.

Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
Barium	7440-39-3	TWA	0.500000	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
	Remarks	Eye, skin, &	Gastrointestinal irr	itation
		Muscular stir	nulation	
		Not classifiat	ole as a human cai	cinogen

TWA	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Eye irritat Muscular Skin irritat Gastrointe Not classi	ion stimulation tion estinal irritation ifiable as a human ca	ırcinogen
TWA	0.500000 mg/m3	USA. NIOSH Recommended Exposure Limits

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance Form: Rods

		Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 725 °C (1,337 °F) - lit.
f)	Initial boiling point and boiling range	1,640 °C (2,984 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	3.6 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
0)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	ner safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Reacts violently with water.
- **10.4 Conditions to avoid** Exposure to moisture

10.5 Incompatible materials

Oxidizing agents, Water, acids, Oxygen, Chlorinated solvents, Carbon dioxide (CO2), Halogens, Halogenated hydrocarbon, Alcohols, Sulphur compounds, Hydrogen sulfide gas

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure Inhalation - May cause respiratory irritation.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: CQ8370000

Stomach/intestinal disorders, Nausea, Vomiting, Drowsiness, Dizziness, Gastrointestinal disturbance, Weakness, Tremors, Seizures.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish mortality NOEC - Cyprinodon variegatus (sheepshead minnow) - 500 mg/l - 96

LC50 - Cyprinodon variegatus (sheepshead minnow) - > 500 mg/l - 96 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

Waste treatment methods 13.1

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1400 Class: 4.3 Proper shipping name: Barium Reportable Quantity (RQ): 1000 lbs	Packing group: II	
Poison Inhalation Hazard: No		
IMDG UN number: 1400 Class: 4.3 Proper shipping name: BARIUM	Packing group: II	EMS-No: F-G, S-O
IATA UN number: 1400 Class: 4.3 Proper shipping name: Barium	Packing group: II	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components		Section 212
The following components are subject to reporting levels establish	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01
SARA 311/312 Hazards Reactivity Hazard, Acute Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Barium	7440-39-3	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

1

W

Eye Irrit.	Eye irritation
H261	In contact with water releases flammable gases.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
Skin Irrit.	Skin irritation
STOT SE	Specific target organ toxicity - single exposure
Water-react.	Substances and mixtures, which in contact with water, emit flammable gases

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	1
NFPA Rating	
Health hazard:	2
Fire Hazard:	3

Reactivity Hazard: Special hazard.I:

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.5

Revision Date: 03/02/2015

Print Date: 05/24/2016

SAFETY DATA SHEET



Benzene

Section 1. Identification

GHS product identifier	: Benzene
Chemical name	: benzene
Other means of identification	: benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol
Product use	: Synthetic/Analytical chemistry.
Synonym	 benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol
SDS #	: 001062
Supplier's details	: Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Emergency telephone number (with hours of operation)	: 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	 FLAMMABLE LIQUIDS - Category 2 SKIN CORROSION/IRRITATION - Category 2 SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2 GERM CELL MUTAGENICITY - Category 1B CARCINOGENICITY - Category 1 SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (bone marrow) - Category 1

GHS label elements	
Hazard pictograms	
Signal word	: Danger
Hazard statements	 Highly flammable liquid and vapor. May form explosive mixtures with air. Causes serious eye irritation. Causes skin irritation. May cause genetic defects. May cause cancer. Causes damage to organs through prolonged or repeated exposure. (bone marrow)
Precautionary statements	
General	: Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand.

Section 2. Hazards identification

Prevention	: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Wear protective gloves. Wear eye or face protection. Keep away from heat, sparks, open flames and hot surfaces No smoking. Use explosion-proof electrical, ventilating, lighting and all material-handling equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Do not breathe vapor. Do not eat, drink or smoke when using this product. Wash hands thoroughly after handling.
Response	: Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF SWALLOWED: Call a POISON CENTER or physician if you feel unwell. Rinse mouth. IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water or shower. IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing. If skin irritation occurs: Get medical attention. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical attention.
Storage	: Store locked up. Store in a well-ventilated place. Keep cool.
Disposal	 Dispose of contents and container in accordance with all local, regional, national and international regulations.
Hazards not otherwise classified	: None known.

Section 3. Composition/information on ingredients

Substance/mixture	:	Substance
Chemical name	:	benzene
Other means of identification	:	benzene, purebenzol; cyclohexatriene; phenyl hydride; phene; coal naphtha; pyrobenzol

CAS number/other identifiers

CAS number	: 71-43-2		
Product code	: 001062		
Ingredient name		%	CAS number
benzene		100	71-43-2

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary	first aid measures
Eye contact	 Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

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Section 4. First aid measures

Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Wash contaminated clothing thoroughly with water before removing it, or wear gloves. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. If material has been swallowed and the exposed person is conscious, give small quantities of water to drink. Stop if the exposed person feels sick as vomiting may be dangerous. Do not induce vomiting unless directed to do so by medical personnel. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. Get medical attention. If necessary, call a poison center or physician. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.

Most important symptoms/effects, acute and delayed

Potential acute health effec	ts
Eye contact	: Causes serious eye irritation.
Inhalation	: No known significant effects or critical hazards.
Skin contact	: Causes skin irritation.
Frostbite	: Try to warm up the frozen tissues and seek medical attention.
Ingestion	: Harmful if swallowed. Irritating to mouth, throat and stomach.
Over-exposure signs/symp	toms
Eye contact	: Adverse symptoms may include the following: pain or irritation watering redness
Inhalation	: No specific data.
Skin contact	: Adverse symptoms may include the following: irritation redness
Ingestion	: No specific data.
Indication of immediate med	ical attention and special treatment needed, if necessary
Notes to physician	 Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific treatments	: No specific treatment.
Protection of first-aiders	: No action shall be taken involving any personal risk or without suitable training. If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Wash contaminated clothing thoroughly with water before removing it, or wear gloves.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media	
Suitable extinguishing media	: Use dry chemical, CO ₂ , water spray (fog) or foam.
Unsuitable extinguishing media	: Do not use water jet.
Specific hazards arising from the chemical	: Highly flammable liquid and vapor. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion. The vapor/gas is heavier than air and will spread along the ground. Vapors may accumulate in low or confined areas or travel a considerable distance to a source of ignition and flash back. Runoff to sewer may create fire or explosion hazard.
Hazardous thermal decomposition products	: Decomposition products may include the following materials: carbon dioxide carbon monoxide
Special protective actions for fire-fighters	: Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool.
Special protective equipment for fire-fighters	: Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions, protect	<u>tiv:</u>	e equipment and emergency procedures
For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing vapor or mist. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	:	Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Methods and materials for co	ont	ainment and cleaning up
Small spill	:	Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Dilute with water and mop up if water-soluble. Alternatively or if water-insoluble, absorb with an inert dry material and place in an appropriate waste disposal container. Dispose of via a licensed waste disposal contractor.
Large spill	:	Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Approach release from upwind. Prevent entry into sewers, water courses, basements or confined areas. Wash spillages into an effluent treatment plant or proceed as follows. Contain and collect spillage with non-combustible, absorbent material e.g. sand, earth, vermiculite or diatomaceous earth and place in container for disposal according to local regulations (see Section 13). Dispose of via a licensed waste disposal contractor. Contaminated absorbent material may pose the same hazard as the spilled product. Note: see Section 1 for emergency contact

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information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling	L	
Protective measures	:	Put on appropriate personal protective equipment (see Section 8). Avoid exposure - obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. Use only non-sparking tools. Take precautionary measures against electrostatic discharges. Empty containers retain product residue and can be hazardous. Do not reuse container.
Advice on general occupational hygiene	:	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
Conditions for safe storage, including any incompatibilities	:	Store in accordance with local regulations. Store in a segregated and approved area. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10) and food and drink. Store locked up. Eliminate all ignition sources. Separate from oxidizing materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
benzene	ACGIH TLV (United States, 3/2012). Absorbed through skin. STEL: 8 mg/m ³ 15 minutes. STEL: 2.5 ppm 15 minutes. TWA: 1.6 mg/m ³ 8 hours. TWA: 0.5 ppm 8 hours. NIOSH REL (United States, 1/2013). STEL: 1 ppm 15 minutes. TWA: 0.1 ppm 10 hours. OSHA PEL (United States, 6/2010). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. OSHA PEL 1989 (United States, 3/1989). STEL: 5 ppm 15 minutes. TWA: 1 ppm 8 hours. OSHA PEL 22 (United States, 11/2006). AMP: 50 ppm 10 minutes. CEIL: 25 ppm TWA: 10 ppm 8 hours.

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Section 8. Exposure controls/personal protection

Appropriate engineering controls	: Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.
Environmental exposure controls	: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.
Individual protection measu	res
Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles.
Skin protection	
Hand protection	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
Other skin protection	: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

Appearance				
Physical state	: Liquid. [Watery liquid.]			
Color	: Colorless. Yellowish.			
Molecular weight	: 78.12 g/mole			
Molecular formula	: C6-H6			
Boiling/condensation point	: 80.09°C (176.2°F)			
Melting/freezing point	: 5.49°C (41.9°F)			
Critical temperature	: 288.95°C (552.1°F)			
Odor	: Characteristic.			
Odor threshold	: Not available.			
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Section 9. Physical and chemical properties

рН	1	Not available.
Flash point	:	Closed cup: -11°C (12.2°F)
Burning time	:	Not applicable.
Burning rate	:	Not applicable.
Evaporation rate	:	3.5 (butyl acetate = 1)
Flammability (solid, gas)	:	Not available.
Lower and upper explosive (flammable) limits	:	Lower: 1.2% Upper: 7.8%
Vapor pressure	:	10 kPa (75.006094245 mm Hg) [room temperature]
Vapor density	:	2.7 (Air = 1)
Specific Volume (ft ³ /lb)	:	1.1403
Gas Density (lb/ft ³)	:	0.877 (20°C / 68 to °F)
Relative density	:	0.88
Solubility	:	Not available.
Solubility in water	:	1.88 g/l
Partition coefficient: n- octanol/water	:	2.13
Auto-ignition temperature	:	498°C (928.4°F)
Decomposition temperature	:	Not available.
SADT	:	Not available.
Viscosity	:	Dynamic (room temperature): 0.604 mPa·s (0.604 cP)

Section 10. Stability and reactivity

Reactivity	1	No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	:	The product is stable.
Possibility of hazardous reactions	:	Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	:	Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition. Do not allow vapor to accumulate in low or confined areas.
Incompatibility with various substances	:	Highly reactive or incompatible with the following materials: oxidizing materials.
Hazardous decomposition products	:	Under normal conditions of storage and use, hazardous decomposition products should not be produced.
Hazardous polymerization	:	Under normal conditions of storage and use, hazardous polymerization will not occur.

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Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
benzene	LC50 Inhalation Gas.	Rat	10000 ppm	7 hours
	LD50 Oral	Rat	930 mg/kg	-

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
benzene	Eyes - Moderate irritant	Rabbit	-	88 milligrams	-
	Eyes - Severe irritant	Rabbit	-	24 hours 2 milligrams	-
	Skin - Mild irritant	Rat	-	8 hours 60 microliters	-
	Skin - Mild irritant	Rabbit	-	24 hours 15 milligrams	-
	Skin - Moderate irritant	Rabbit	-	24 hours 20 milligrams	-

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Classification

Product/ingredient name	OSHA	IARC	NTP
benzene	+	1	Known to be a human carcinogen.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Name	Category	Route of exposure	Target organs
benzene	Category 1	Not determined	bone marrow

Aspiration hazard

Not available.

Information on the likely : Not available.

routes of exposure

Potential acute health effects

Eye contact	: Causes serious eye irritation.
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Inhalation	÷	No known significant effects or critical hazards.

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Section 11. Toxicological information

	<u> </u>	
Skin contact	: Causes skin irritation.	
Ingestion	: Harmful if swallowed. Irritating to mouth, throat and stomach.	
Symptoms related to the phy	ical, chemical and toxicological characteristics	
Eye contact	: Adverse symptoms may include the following: pain or irritation watering redness	
Inhalation	: No specific data.	
Skin contact	: Adverse symptoms may include the following: irritation redness	
Ingestion	: No specific data.	
Delayed and immediate effe	s and also chronic effects from short and long term exposure	
<u>Short term exposure</u>		
Potential immediate effects	: Not available.	
Potential delayed effects	: Not available.	
<u>Long term exposure</u>		
Potential immediate effects	: Not available.	
Potential delayed effects	: Not available.	
Potential chronic health eff	<u>ets</u>	
Not available.		
General	: Causes damage to organs through prolonged or repeated exposure.	
Carcinogenicity	: May cause cancer. Risk of cancer depends on duration and level of exposure.	
Mutagenicity	: May cause genetic defects.	
Teratogenicity	: No known significant effects or critical hazards.	
Developmental effects	: No known significant effects or critical hazards.	
Fertility effects	: No known significant effects or critical hazards.	

Numerical measures of toxicity

Acute toxicity estimates Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

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 Benzene

 Section 12. Ecological information

 Product/ingredient name
 LogPow
 BCF
 Potential

 benzene
 2.13
 11
 low

<u>Mobility in soil</u>

coefficient (Koc)

Soil/water partition

: Not available.

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

- **Disposal methods**
- : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Care should be taken when handling emptied containers that have not been cleaned or rinsed out. Empty containers or liners may retain some product residues. Vapor from product residues may create a highly flammable or explosive atmosphere inside the container. Do not cut, weld or grind used containers unless they have been cleaned thoroughly internally. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Benzene (I,T)	71-43-2	Listed	U019

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1114	UN1114	UN114	UN1114	UN1114
UN proper shipping name	BENZENE	BENZENE	BENZENE	BENZENE	BENZENE
Transport hazard class(es)	3	3	3	3	3
Packing group	11	11	П	Ш	11
Environment	No.	No.	No.	No.	No.
Additional information	Reportable quantity 10 lbs / 4.54 kg [1.3675 gal / 5.1767 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements.	Explosive Limit and Limited Quantity Index 1 Passenger Carrying Road or Rail Index 5	-	-	Passenger and Cargo AircraftQuantity limitation: 5 L Cargo Aircraft Only Quantity limitation: 60 L Limited Quantities - Passenger Aircraft Quantity limitation: 1 L

 Benzene

 Section 14. Transport information

 Limited quantity Yes.
 Packaging instruction Passenger aircraft Quantity limitation: 5 L
 Cargo aircraft Quantity limitation: 60 L

 Special provisions IB2, T4, TP1
 Benzene
 Benzene

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according : Not available. to Annex II of MARPOL 73/78 and the IBC Code

Section 15. Regulatory information

U.S. Federal regulations	 TSCA 8(a) CDR Exempt/Partial exemption: Not determined United States inventory (TSCA 8b): This material is listed or exempted. Clean Water Act (CWA) 307: benzene Clean Water Act (CWA) 311: benzene
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	: Listed
Clean Air Act Section 602 Class I Substances	: Not listed
Clean Air Act Section 602 Class II Substances	: Not listed
DEA List I Chemicals (Precursor Chemicals)	: Not listed
DEA List II Chemicals (Essential Chemicals)	: Not listed
<u>SARA 302/304</u>	
Composition/information	on ingredients
No products were found.	
SARA 304 RQ	: Not applicable.
<u>SARA 311/312</u>	
Classification	: Fire hazard Immediate (acute) health hazard Delayed (chronic) health hazard
Composition/information	on ingredients

Section 15. Regulatory information

N	Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
b	benzene	100	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	benzene	71-43-2	100
Supplier notification	benzene	71-43-2	100

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts	: This material is listed.
New York	: This material is listed.
New Jersey	: This material is listed.
Pennsylvania	: This material is listed.

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

Ingredient name		Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
benzene		Yes.	Yes.	6.4 μg/day (ingestion) 13 μg/day (inhalation)	24 μg/day (ingestion) 49 μg/day (inhalation)
Canada inventory	: This ma	terial is listed	or exempted.		
International regulations					
	China ir Japan iı Korea ir Malaysi New Zea Philippi Taiwan	iventory (IEC nventory: Thi nventory: Thi a Inventory (aland Inventor nes inventor inventory (C	CSC): This material is is material is listed of s material is listed of EHS Register): Not ory of Chemicals (I ry (PICCS): This ma SNN): Not determin	is listed or exempted. or exempted. or exempted. determined. NZIOC) : This material is terial is listed or exempt ed.	listed or exempted. ed.
Chemical Weapons Convention List Schedule I Chemicals	: Not liste	d			
Chemical Weapons Convention List Schedule Il Chemicals	: Not liste	d			
Chemical Weapons Convention List Schedule III Chemicals	: Not liste	d			
<u>Canada</u>					

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Section 15. Regulatory information

WHMIS (Canada)	: Class B-2: Flammable liquid Class D-2A: Material causing other toxic effects (Very toxic). Class D-2B: Material causing other toxic effects (Toxic).
	 CEPA Toxic substances: This material is listed. Canadian ARET: This material is not listed. Canadian NPRI: This material is listed. Alberta Designated Substances: This material is not listed. Ontario Designated Substances: This material is not listed. Quebec Designated Substances: This material is not listed.

Section 16. Other information

Class B-2: Flammable liquid Class D-2A: Material causing other toxic effects (Very toxic).

Class D-2B: Material causing other toxic effects (Toxic).

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



: 0.03

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

<u>History</u>	
Date of printing	: 4/26/2015.
Date of issue/Date of revision	: 4/26/2015.
Date of previous issue	: 10/16/2014.

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Section 16. Other information

Kou to obbroviationa	ATE - Aguta Taviaity Estimata
Rey to appreviations .	ATE - Acute Toxicity Estimate
	BUF = Bioconcentration Factor
	GHS = Globally Harmonized System of Classification and Labelling of Chemicals
	IATA = International Air Transport Association
	IBC = Intermediate Bulk Container
	IMDG = International Maritime Dangerous Goods
	LogPow = logarithm of the octanol/water partition coefficient
	MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships,
	1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution)
	UN = United NationsACGIH – American Conference of Governmental Industrial
	Hygienists
	AIHA – American Industrial Hygiene Association
	CAS – Chemical Abstract Services
	CEPA – Canadian Environmental Protection Act
	CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
	(EPA)
	CFR – United States Code of Federal Regulations
	CPR – Controlled Products Regulations
	DSL – Domestic Substances List
	GWP – Global Warming Potential
	IARC – International Agency for Research on Cancer
	ICAO – International Civil Aviation Organisation
	Inh – Inhalation
	LC – Lethal concentration
	LD – Lethal dosage
	NDSL – Non-Domestic Substances List
	NIOSH – National Institute for Occupational Safety and Health
	TDG – Canadian Transportation of Dangerous Goods Act and Regulations
	TLV – Threshold Limit Value
	TSCA – Toxic Substances Control Act
	WEEL – Workplace Environmental Exposure Level
	WHMIS – Canadian Workplace Hazardous Material Information System
References :	Not available.

V Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Date of issue/Date of revision : 4/26/2015. Date of previous	s issue : 10/16/2014. Version : 0.03 14/1
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SAFETY DATA SHEET

Based on Directive 2001/58/EC et seq. of the Commission of the European Communities

BENZO[b]FLUORANTHENE

Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms:

benz[e]acephenanthrylene

CAS No. EC index No.	:	205-99-2 601-034-00-4	BCR number NFPA code	:	BCR-47 N.D.
EINECS No. RTECS No.	:	205-911-9 CU1400000	Molecular weight Formula	:	252.32 C ₂₀ H ₁₂

1.2 Use of the substance or the preparation: Certified reference material for laboratory use only

1.3 Company/undertaking identification:

Institute for Reference Materials and Measurements Retieseweg B-2440 Geel Tel. : +32 14 57 12 11 Fax : +32 14 58 42 73

1.4 Telephone number for emergency: +32 70 245 245 Antigifcentrum p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

Composition/information on ingredients

Hazardous ingredients	CAS No. EINECS No.	Conc. in %	Hazard symbol	Risks (R-phrases)
benzo[b]fluoranthene	205-99-2	100	Τ;Ν	45-50/53 (1)
	205-911-9			

(1) For R-phrases in full: see heading 16

Hazards identification 3.

May cause cancer

- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:

- Consult a doctor/medical service if irritation persists
- Rinse immediately with water
- Do not apply neutralizing agents

4.2 Skin contact:

- Consult a doctor/medical service if irritation persists
- Wash with water and soap
 Remove clothing before washing
 Do not apply (chemical) neutralizing agents

4.3 After inhalation:

- Consult a doctor/medical service if breathing problems develop
- Remove the victim into fresh air
 Unconscious: maintain adequate airway and respiration

4.4 After ingestion:

Consult a doctor/medical service if you feel unwell

Printing date Compiled by	:	07-2002 Brandweerinformatiece Technische Schoolstra ☎ +32 14 58 45 47	ntrum voor Gevaarli at 43 A, B-2440 Gee http://www.big.be	jke 1	E Stoffen vzw (BIG) E-mail: info@big.be	1 / 8
MSDS established Reference number Reason for revision	::	BIG\18244GB Directive 2001/58/EC	Revision date Revision number	:	28-02-2002 001	

BENZO[b]FLUORANTHENE

- Immediately give lots of water to drink
 Never give water to an unconscious person
 Do not induce vomiting

Fire-fighting measures 5.

5.1 Suitable extinguishing media:

- Water spray Polymer foam ABC powder Carbon dioxide
- 5.2 Unsuitable extinguishing media: Solid water jet ineffective as extinguishing medium
- 5.3 Special exposure hazards:
 - Not easily combustible Upon combustion CO and CO2 are formed

5.4 Instructions:

- Take account of toxic firefighting water
 Use firefighting water moderately and contain it
- 5.5 Special protective equipment for firefighters: - Heat/fire exposure: compressed air/oxygen apparatus - Dust cloud production: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal protection/precautions: see 8.1/8.3/10.3

6.2 Environmental precautions:

- Prevent soil and water pollution
 Substance must not be discharged into the sewer
 Dam up the solid spill

- 6.3 Methods for cleaning up: Stop dust cloud by covering with sand/earth Carefully collect the spill/leftovers Scoop solid spill into closing containers Take collected spill to manufacturer/competent authority Clean contaminated surfaces with an excess of water Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:

- Observe strict hygiene
 Avoid prolonged and repeated contact with skin
 Avoid raising dust
 Do not discharge the waste into the drain
 Clean contaminated clothing

7.2 Storage:

- Keep container tightly closed.
 Store in a cool area
 Store in a dry area

- Store in a dark area Keep away from: heat sources, ignition sources, oxidizing agents, acids

Storage temperature	:	N.D.	°C	
Quantity limits	:	N.D.		kg
Storage life	:	N.D.		-
Materials for packaging	:	N.D.		

7.3 Specific uses: N.D.
Exposure controls/Personal protection 8.

8.1 Exposure limit values:

TLV-TWA	:	not	listed
TLV-STEL	:	not	listed
TLV-Ceiling	:	not	listed
OES-LTEL	::	not	listed
OES-STEL		not	listed
MEL-LTEL		not	listed
MEL-STEL		not	listed
MAK	:	not	listed
TRK	:	not	listed
MAC-TGG 8 h	:	not	listed
MAC-TGG 15 min.	:	not	listed
MAC-Ceiling	:	not	listed
VME-8 h	:	not	listed
VLE-15 min.		not	listed
GWBB-8 h	::	not	listed
GWK-15 min.		not	listed
Momentary value		not	listed

Sampling methods:

-	Benzo(b)fluoranthene	(Polynuclear	aromatic	hydrocarbons)	NIOSH	5515
-	Benzo(b)fluoranthene	(Polynuclear	aromatic	hydrocarbons)	NIOSH	5506

8.2 Exposure controls:

8.2.1 Occupational exposure controls: Measure the concentration in the air regularly
 Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see 13

8.3 Personal protection:

- 8.3.1 respiratory protection: - Dust production: dust mask with filter type P3 - High dust production: compressed air/oxygen apparatus

8.3.2 hand protection: - Gloves

Suitable materials: No data available

- Breakthrough time: N.D.

8.3.3 eye protection:

Safety glasses
 In case of dust production: protective goggles

Suitable materials: No data available

Physical and chemical properties 9.

9.1 General information:

Appearance (at 20°C)	: Crystalline solid / Needles
Odour	: Odourless
Colour	: Colourless to off-white

9.2 Important health, safety and environmental information:

<pre>pH value Boiling point/boiling range Flashpoint Explosion limits Vapour pressure (at 20°C) Vapour pressure (at 50°C) Relative density (at 20°C) Water solubility Soluble in Relative vapour density Viscosity Partition coëfficient n-octanol/water Evaporation rate ratio butyl acetate ratio ether</pre>		N.D. N.D. N.D. 0.00000067 N.D. N.D. 0.00000012 Acetone, oi N.D. 6.57 N.D. N.D. N.D.	°C vol% (hPa hPa g/100 ml ls/fats Pa.s	°C)
Other information:				
Melting point/melting range Auto-ignition point Saturation concentration	:	168 N.D. N.D.	°C °C g/m³	

Stability and reactivity 10.

9.3

10.1 Conditions to avoid/reactivity:

Stable under normal conditions

10.2 Materials to avoid: - Keep away from: heat sources, ignition sources, oxidizing agents, acids

- 10.3 Hazardous decomposition products: - Upon combustion CO and CO2 are formed - Reacts violently with (strong) oxidizers - Decomposes on exposure to (strong) acids

5/8

Toxicological information

11.1 Acute toxicity:

LD50 oral rat	: N.D.	mg/kg
LD50 dermal rat	: N.D.	mg/kg
LD50 dermal rabbit	: N.D.	mg/kg
LC50 inhalation rat	: N.D.	mg/174 h
LC50 inhalation rat	: N.D.	ppm/4 h

11.2 Chronic toxicity:

benzo[b]fluoranthene

EC carc. cat.	: 2
EC muta. cat.	: not listed
EC repr. cat.	: not listed
Carcinogenicity (TLV)	: A2
Carcinogenicity (MAC)	: K
Carcinogenicity (VME)	: not listed
Carcinogenicity (GWBB)	: not listed
Carcinogenicity (MAK)	: 2
Mutagenicity (MAK)	: not listed
Teratogenicity (MAK)	: -
IARC classification	: 2B
11.3 Routes of exposure:	ingestion, inhalation, eyes and skin Caution! Substance is absorbed through the skin

11.4 Acute effects/symptoms:

- AFTER SKIN CONTACT Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic - Not classified as toxic to reproduction (EC)
- ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: No specific information available
- SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:

Feeling of weakness Cracking of the skin Skin rash/inflammation Photoallergy Skin cancer Lung tissue affection/degeneration Enlargement/affection of the liver Affection of the renal tissue

12. **Ecological information**

12.1 Ecotoxicity:

- - No data available

12.2 Mobility:

- Volatile organic compounds (VOC): 0%
- Photolysis in water
- Forming sediments in water Insoluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- biodegradation BOD₅ N.D. % ThOD : - Not readily biodegradable in water - test: E 1/2 > 100 d. - water : : T ½: > 87 - soil days

12.4 Bioaccumulative potential:

- log P_{ow} BCF : 6.57 : 168 h : 2800 (LAMELLIBRANCHIATA)
- Highly bioaccumulative

12.5 Other adverse effects:

- (Classification based on the R-phrases in compliance with WGK : 3 Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)
- Effect on the ozone layer
- Greenhouse effect

: Not dangerous for the ozone layer (Council Regulation (EC) No 3093/94, O.J. L333 of 22/12/94) no data available

: no data available

- Effect on waste water purification

13. **Disposal considerations**

13.2 Disposal methods:

- Dissolve or mix with a combustible solvent
 Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber
- Do not discharge into surface water (2000/60/EEC, Council Decision 2455/2001/EC, O.J. L331 of 15/12/2001)

13.3 Packaging/Container:

Waste material code packaging (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

14. Transport information



14.1	Classification of the substance in compliance UN number CLASS SUB RISKS PACKING PROPER SHIPPING NAME	<pre>with UN Recommendations : 3077 : 9 : - : III : UN 3077, Environmentally hazardous substance, solid, n.o.s. (benz[e]acephenanthrylene)</pre>
14.2	ADR (transport by road) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	: 9 : III : 9 : 9
14.3	RID (transport by rail) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	: 9 : III : 9 : 9
14.4	ADNR (transport by inland waterways) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	: 9 : III : 9 : 9
14.5	IMDG (maritime transport) CLASS SUB RISKS PACKING MFAG EMS MARINE POLLUTANT	: 9 : - : III : - : - : P
14.6	ICAO (air transport) CLASS SUB RISKS PACKING PACKING INSTRUCTIONS PASSENGER AIRCRAFT PACKING INSTRUCTIONS CARGO AIRCRAFT	: 9 : - : III :
14.7	Special precautions in connection with transport	: none
	When substances and their packaging meet the ADR/RID/ADNR in chapter 3.4, only the followi complied with: each package shall display a diamond-shaped f inscription: - 'UN 3077' or, in the case of different goods with diffe within a single package: - the letters 'LQ'	conditions established by ng prescriptions shall be igure with the following rent identification numbers

15. **Regulatory information**

Enumerated in substance list Annex I of directive 67/548/EEC et sequens





Dangerous for the environment

R45 R50/53	 May cause cancer Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
S53	: Avoid exposure - obtain special instructions before use
S45	: In case of accident or if you feel unwell, seek medical advice (show the label where possible)
S60	: This material and/or its container must be disposed of as hazardous waste
S61	: Avoid release to the environment. Refer to special

16. **Other information**

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or guality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

N.A. =	NOT	APPLICABLE
--------	-----	------------

- N.D. = NOT DETERMINED +
- = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45		
DEO	/ 5 2	

: May cause cancer Very toxic to aquatic organisms, may cause long-term adverse effects in the R50/53 aquatic environment

Exposure limits:

TLV	:	Threshold Limit Value - ACGIH USA 2000
OES	:	Occupational Exposure Standards - United Kingdom 1999
MEL	:	Maximum Exposure Limits - United Kingdom 1999
MAK	:	Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK	:	Technische Richtkonzentrationen – Germany 2001
MAC	:	Maximale aanvaarde concentratie - The Netherlands 2002
VME	:	Valeurs limites de Moyenne d'Exposition - France 1999
VLE	:	Valeurs limites d'Exposition à court terme - France 1999
GWBB	:	Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK	:	Grenswaarde kortstondige blootstelling – Belgium 1998
EC	:	Indicative occupational exposure limit values - directive 2000/39/EC

instructions/safety data sheets.

Chronic toxicity:

: List of the carcinogenic substances and processes - The Netherlands 2002 к

SAFETY DATA SHEET

Based on Regulation (EC) No. 1907/2006 (REACH) Article 31 and Annex II

BCR-048R: benzo[k]fluoranthene

1. Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Product name: BCR-048R: benzo[k]fluoranthene
CAS number	207-08-9
EC index number	601-036-00-5
EINECS number	205-916-6
RTECS number	DF6350000
Molecular mass	252.32 g/mol
Formula	C20H12

1.2 Use of the substance/preparation:

Certified reference material for laboratory use only

1.3 Company/undertaking identification:

Institute for Reference Materials and Measurements Retieseweg B-2440 Geel Tel: +32 14 57 12 11 Fax: +32 14 59 04 06 JRC-IRMM-RM-Sales@ec.europa.eu

1.4 Emergency telephone:

Poison Centre: +32 70 245 245

2. Hazards identification

NFPA: 1-1-2(*)

DSD/DPD

May cause cancer Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Other hazards

Its dust is explosive with air Dust cloud can be ignited by a spark Slightly irritant to skin Slightly irritant to eyes Caution! Substance is absorbed through the skin No certainty about human mutagenic properties Highly bioaccumulative

Not readily biodegradable in water

CLP

 Carc. 1B
 May cause cancer. (H350)

 Aquatic Acute 1
 Very toxic to aquatic life. (H400)

 Aquatic Chronic 1
 Very toxic to aquatic life with long lasting effects. (H410)

Other hazards

Its dust is explosive with air Dust cloud can be ignited by a spark Slightly irritant to skin Slightly irritant to eyes Caution! Substance is absorbed through the skin No certainty about human mutagenic properties Highly bioaccumulative Not readily biodegradable in water

Created by: Brandweerinformatiecentrum voor Gevaarlijke Stoffen vzw (BIG) Technische Schoolstraat 43 A, B-2440 Geel http://www.big.be Publication date: 2002-03-27 Date of revision: 2010-11-19

Reason for revision: CLP Revision number: 0200

Product number: 49287

Reference number: BCR-048R

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GВ

3. Composition/information on ingredients

Name	CAS No EINECS/ELINCS	Conc.	Classification according to DSD/DPD	Classification according to CLP	Note
benzo[k]fluoranthene	207-08-9		Carc. Cat. 2; R45	Carc. 1B; H350	
	205-916-6		N; R50-53	Aquatic Acute 1; H400	
				Aquatic Chronic 1; H410	

4. First aid measures

4.1 After inhalation:

Remove the victim into fresh air Respiratory problems: consult a doctor/medical service

4.2 Skin contact:

Rinse with water

Do not apply (chemical) neutralizing agents Take victim to a doctor if irritation persists

4.3 Eye contact:

Rinse with water Do not apply neutralizing agents Take victim to an ophthalmologist if irritation persists.

4.4 After ingestion:

Rinse mouth with water Immediately after ingestion: give lots of water to drink Do not induce vomiting Consult a doctor/medical service if you feel unwell

5. Fire-fighting measures

5.1 Suitable extinguishing media:

Water spray Polyvalent foam ABC powder Carbon dioxide

5.2 Unsuitable extinguishing media:

No unsuitable extinguishing media known

5.3 Special exposure hazards:

Heating increases the fire hazard Dust cloud can be ignited by a spark Upon combustion CO and CO2 are formed

5.4 Instructions:

Take account of toxic fire-fighting water Use water moderately and if possible collect or contain it

5.5 Special protective equipment for fire-fighters:

Gloves

Protective clothing

Heat/fire exposure: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal precautions:

See heading 8.2

6.2 Environmental precautions:

Dam up the solid spill Prevent soil and water pollution Prevent spreading in sewers

Revision number: 0200

Product number: 49287

Reference number: BCR-048R

See heading 13

6.3 Methods for cleaning up:

Scoop solid spill into closing containers

Carefully collect the spill/leftovers

Clean contaminated surfaces with an excess of water

Take collected spill to manufacturer/competent authority

Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:

Avoid raising dust Warning! Avoid exposure Keep away from naked flames/heat Obtain special instructions before use Observe strict hygiene Keep container tightly closed Do not discharge the waste into the drain

7.2 Storage:

Safe storage requirements:

Store in a cool area

Store in a dry area

Keep container in a well-ventilated place

Keep locked up

Unauthorized persons are not admitted Meet the legal requirements

Keep away from:

oxidizing agents

(strong) acids

7.3 Specific use(s):

See information supplied by the manufacturer for the identified use(s)

8. Exposure controls/Personal protection

8.1 Exposure limit values:

8.1.1 Occupational exposure:

If limit values are applicable and available these will be listed below.

8.1.2 Sampling methods:

Product name	Test	Number	Sampling method	Remarks
Benz(a)Anthracene	OSHA	CSI		
Benz(a)Anthracene (Polynuclear aromatic hydrocarbons)	NIOSH	5506	adsorption tubes	
Benz(a)Anthracene (Polynuclear aromatic hydrocarbons)	NIOSH	5515	adsorption tubes	

8.2 Exposure controls:

Revision number: 0200	Product number: 49287	Reference number: BCR-048R	3/8
8.2.2 Environmental exposure cont	rols:		
Protective clothing			
d) Skin protection:			
In case of dust pro	duction: protective goggles		
Safety glasses			
C) Eye protection.			
c) Eve protection:			
Gloves			
b) Hand protection:			
Dust production: c	lust mask with filter type P3		
a) Respiratory protectio	n:		
Personal protective equipment	nt:		
Carry operations in the open/	under local exhaust/ventilation or with respirator	y protection	
Measure the concentration ir	n the air regularly		
8.2.1 Occupational exposure control	ols:		

See headings 6.2, 6.3 and 13

9. Physical and chemical properties

9.1 General information:

Physical form	Crystalline solid	
	Needles	
Colour	Light yellow	

9.2 Important health, safety and environmental information:

Boiling point	480 °C
Vapour pressure (20°C)	< 0.00001 hPa
Solubility in water	< 0.00001 g/100 ml
Solubility in solvents	Soluble in ethanol
	Soluble in acetic acid
	Soluble in oils/fats
Log Pow	6.84

9.3 Other information:

Melting point

217 °C

10. Stability and reactivity

10.1 Conditions to avoid:

Possible fire hazard

heat sources ignition sources

Stability

No data available

Reactions

Reacts violently with (strong) oxidizers

10.2 Materials to avoid:

oxidizing agents (strong) acids

10.3 Hazardous decomposition products:

Upon combustion CO and CO2 are formed

11. Toxicological information

11.1 Acute toxicity:

No (test)data available.

11.2 Chronic toxicity:

Probably human carcinogenic No certainty about human mutagenic properties

Not classified as toxic to reproduction (EC)

BCR-048R: benzo[k]fluoranthene

EC carc cat	2
Listed in SZW - List of carcinogenic substances	yes
IARC - classification	2B
MAK - Krebserzeugend Kategorie	2
MAK - Keimzellmutagen Kategorie	3B
MAK - Schwangerschaft Gruppe	-
CLP carc cat	category 1B

11.3 Acute effects/symptoms:

Inhalation:

No data available

Skin contact:

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0 %

6.84

Insoluble in water

Adsorbs into the soil

Ozonation in water 65 - 1400 days

Forming sediments in water

Slight irritation

Eye contact: Slight irritation

Ingestion:

No data available

11.4 Chronic effects:

ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: No specific information available SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS: Feeling of weakness Cracking of the skin Skin rash/inflammation Photoallergy Skin cancer Lung tissue affection/degeneration Enlargement/affection of the liver Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:

No (test)data available.

12.2 Mobility:

Volatile organic compounds (VOC) Solubility in/reaction with water Water physicochemical processes Soil physicochemical processes

12.3 Persistence and degradability:

Water abiotic degradation processes Half-life soil

Not readily biodegradable in water

12.4 Bioaccumulative potential: Log Pow

Highly bioaccumulative

12.5 Results of PBT assessment:

Not applicable, based on available data

12.6 Other adverse effects:

Not dangerous for the ozone layer (Council Regulation (EC) no 1005/2009)

13. Disposal considerations

13.1 Provisions relating to waste:

Waste material code (Directive 2008/98/EC, decision 2001/118/EC)

16 05 06* : laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory chemicals Depending on branch of industry and production process, also other EURAL codes may be applicable Hazardous waste according to Directive 2008/98/EC

13.2 Disposal methods:

Dissolve or mix with a combustible solvent Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber with energy recovery

Remove waste in accordance with local and/or national regulations

Do not discharge into surface water (2000/60/EC, Council decision 2455/2001/EC, O.J. L331 of 15/12/2001)

13.3 Packaging/Container:

Waste material code packaging (Directive 2008/98/EC) 15 01 10* : packaging containing residues of or contaminated by dangerous substances

{13.4 Entsorgung verschmutzter Gebinde:}

Revision number: 0200

Product number: 49287

Reference number: BCR-048R

14. Transport information

ADR	
Proper shipping name	Environmentally hazardous substance, solid, n.o.s.
Techn./chem. name ADR	benzo[k]fluoranthene
UN number	3077
Class	9
Packing group	Ш
Hazard identification number	90
Classification code	M7
Labels	9
Environmentally hazardous substance mark	yes

RID

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.
Techn./chem. name RID	benzo[k]fluoranthene
UN number	3077
Class	9
Packing group	III
Classification code	M7
Labels	9
Environmentally hazardous substance mark	yes
ADNR	

ADNR

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.
Techn./chem. name ADNR	benzo[k]fluoranthene
UN number	3077
Class	9
Packing group	
Classification code	M7
Labels	9
Environmentally hazardous substance mark	ves

ІМО

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.
Techn./chem. name IMO	benzo[k]fluoranthene
UN number	3077
Class	9
Packing group	Ш
Labels	9
Marine pollutant	Р
Environmentally hazardous substance mark	ves

ICAO

Proper shipping name	Environmentally hazardous substance, solid, n.o.s.	
Techn./chem. name ICAO	benzo[k]fluoranthene	
UN number	3077	
Class	9	
Packing group	Ш	
Labels	9	
Environmentally hazardous substance mark	yes	

15. Regulatory information

15.1 EU Legislation:

Revision number: 0200

Product number: 49287

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DSD/DPD

Enumerated in substance list Annex I of directive 67/548/EEC et sequens





environment

R-phrases

	45	May cause cancer
	50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment
j		

S-phrases

Additional recommendations

Restricted to professional users.

CLP

Classification and labelling according to Regulation (EC) No 1272/2008 – Annex VI and after evaluation of available test data



Danger

Signal word

Dgr

H-statements

H350	May cause cancer.
H410	Very toxic to aquatic life with long lasting effects.

P-statements

P202	Do not handle until all safety precautions have been read and understood.
P281	Use personal protective equipment as required.
P273	Avoid release to the environment.
P308 + P313	IF exposed or concerned: Get medical advice/attention.
P391	Collect spillage.
P405	Store locked up.

Supplemental information

Restricted to professional users.

15.2 National provisions:

15.3 Specific community rules:

Enumerated in Annex XVII of Regulation (EC) No. 1907/2006: Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles.

Legislation	Reference legislation
EG/552/2009	See column 1: 28.
EG/552/2009	See column 1: 50. g)

16. Other information

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Revision number: 0200
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The information in this safety data sheet is based on data and samples provided to BIG. The sheet was written to the best of our ability and according to the state of knowledge at that time. The safety data sheet only constitutes a guideline for the safe handling, use, consumption, storage, transport and disposal of the substances/preparations/mixtures mentioned under point 1. New safety data sheets are written from time to time. Only the most recent versions may be used. Old versions must be destroyed. Unless indicated otherwise word for word on the safety data sheet, the information does not apply to substances/preparations/mixtures in purer form, mixed with other substances or in processes. The safety data sheet offers no quality specification for the substances/preparations/mixtures in question.

Compliance with the instructions in this safety data sheet does not release the user from the obligation to take all measures dictated by common sense, regulations and recommendations or which are necessary and/or useful based on the real applicable circumstances. BIG does not guarantee the accuracy or exhaustiveness of the information provided. Use of this safety data sheet is subject to the licence and liability limiting conditions as stated in your BIG licence agreement. All intellectual property rights to this sheet are the property of BIG and its distribution and reproduction are limited. Consult your BIG licence agreement for details.

(*) = INTERNAL CLASSIFICATION (NFPA)

PBT-substances = persistent, bioaccumulative and toxic substances

- DSD Dangerous Substance Directive
- DPD Dangerous Preparation Directive CLP (EU-GHS) Classification, labelling and packaging (Globally Harmonised System in Europe)

Full text of any R-phrases referred to under headings 2 and 3:

R45	May cause cancer
R50/53	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

Full text of any H-statements referred to under headings 2 and 3:

H350	May cause cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

Full text of any classes referred to under headings 2 and 3:

Aquatic Acute	Hazardous to the aquatic environment - acute
Aquatic Chronic	Hazardous to the aquatic environment - chronic
Carc.	Carcinogenicity

SAFETY DATA SHEET

Based on Directive 2001/58/EC et seq. of the Commission of the European Communities

BENZ[a]ANTHRACENE

Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms: benzo(a)anthracene

CAS No.	:	56-55-3	BCR number	:	BCR-271
EC index No.	:	601-033-00-9	NFPA code Molecular weight	:	N.D. 228 30
RTECS No.	÷	CV9275000	Formula	÷	C18H12

1.2 Use of the substance or the preparation: Certified reference material for laboratory use only

Company/undertaking identification: Institute for Reference Materials and Measurements 1.3 Retieseweg B-2440 Geél Tel.: +32 14 57 12 11 Fax : +32 14 58 42 73

1.4 Telephone number for emergency: +32 70 245 245 Antigifcentrum p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

Composition/information on ingredients

Hazardous ingredients	CAS No. EINECS No.	Conc. in %	Hazard symbol	Risks (R-phrases)
Benzo[a]anthracene	56-55-3	100	Τ;Ν	45-50/53 (1)
	200-280-6			

(1) For R-phrases in full: see heading 16

Hazards identification 3.

May cause cancer

- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:

- Consult a doctor/medical service if irritation persists
- Rinse immediately with water

4.2 Skin contact:

- Consult a doctor/medical service if irritation persists
 Wash with water and soap
 Remove clothing before washing

4.3 After inhalation:

- Consult a doctor/medical service if breathing problems develop
 Remove the victim into fresh air
 Unconscious: maintain adequate airway and respiration

4.4 After ingestion:

- Consult a doctor/medical service if you feel unwell
 Immediately give lots of water to drink
 Never give water to an unconscious person

Printing date Compiled by	:	07-2002 Brandweerinformatiecentrum voor Gevaarlijke Stoffen vzw (BIG) Technische Schoolstraat 43 A, B-2440 Geel				1 / 8
		☎ +32 14 58 45 47	http://www.big.be		E-mail: info@big.be	
MSDS established Reference number Reason for revision	: : :	BIG\18241GB Directive 2001/58/EC	Revision date Revision number	:	28-03-2002 001	

Fire-fighting measures 5.

5.1 Suitable extinguishing media:

- _
- Water spray Alcohol foam Polymer foam ABC powder
- Carbon dioxide

5.2 Unsuitable extinguishing media:

Solid water jet ineffective as extinguishing medium

5.3 Special exposure hazards:

- Not easily combustible
 Upon combustion CO and CO2 are formed

5.4 Instructions:

- Take account of toxic firefighting water
 Use firefighting water moderately and contain it

6. Accidental release measures

6.1 Personal protection/precautions: see heading 8.1/8.3/10.3

6.2 Environmental precautions:

- Prevent soil and water pollution
 Substance must not be discharged into the sewer
 Dam up the solid spill

- 6.3 Methods for cleaning up: Stop dust cloud by covering with sand/earth Carefully collect the spill/leftovers Scoop solid spill into closing containers Take collected spill to manufacturer/competent authority Clean contaminated surfaces with an excess of water Wash clothing and equipment after handling

7. Handling and storage

7.1 Handling:

- Observe strict hygiene
 Avoid prolonged and repeated contact with skin
 Avoid raising dust
 Do not discharge the waste into the drain
- Remove contaminated clothing immediately

7.2 Storage:

- Keep container tightly closed. Store in a cool area. Store in a dry area.
 Store in a dark area.
 Keep away from: heat sources, ignition sources, oxidizing agents, acids

Storage temperatur Quantity limits Storage life Materials for pack	e aging	: N.D. N.D. N.D.	°C kg
- suitable	: no dat	a available	

- to avoid : no data available

7.3 Specific uses:

See information supplied by the manufacturer

Exposure controls/Personal protection 8

8.1 Exposure limit values:

TLV-TWA	:	mg/m ³ –	ppm
TLV-STEL		mg/m ³ –	ppm
TLV-Ceiling		mg/m ³	ppm
OES-LTEL	:	mg/m³	ppm
OES-STEL		mg/m³	ppm
MAK	:	mg/m³	ppm
TRK		mg/m³	ppm
MAC-TGG 8 h MAC-TGG 15 min. MAC-Ceiling	:	mg/m³ mg/m³ mg/m³	
VME-8 h	:	mg/m ³	ppm
VLE-15 min.		mg/m ³	ppm
GWBB-8 h	:	mg/m³	ppm
GWK-15 min.		mg/m³	ppm
Momentary value		mg/m³	ppm
EC	:	mg/m³	ppm
EC-STEL		mg/m³	ppm

Sampling methods:

-	Benz(a)Anthracene	(Polynuclear	aromatic	hydrocarbons)	NIOSH	5506
-	Benz(a)Anthracene	(Polynuclear	aromatic	hydrocarbons)	NIOSH	5515
-	Benz (a) Anthracene				OSHA	CSI

8.2 Exposure controls:

8.2.1 Occupational exposure controls: - Measure the concentration in the air regularly - Work under local exhaust/ventilation

8.2.2 Environmental exposure controls: see heading 13

8.3 Personal protection:

8.3.1 respiratory protection: - Dust production: dust mask with filter type P3 - High dust production: compressed air/oxygen apparatus

8.3.2 hand protection:

- Gloves Suitable materials: No data available
- Breakthrough time: N.D.

8.3.3 eye protection:

- Safety glasses - In case of dust production: protective goggles

8.3.4 skin protection:

- Protective clothing
 In case of dust production: head/neck protection Suitable materials: No data available

Physical and chemical properties 9.

9.1 General information:

Appearance (at 20°0) : Crystalline solid / Scales
Odour	: Odourless
Colour	: Colourless to fluorescent
	yellow-green

9.2 Important health, safety and environmental information:

pH value Boiling point/boiling range Flashpoint Explosion limits Vapour pressure (at 20°C) Vapour pressure (at 50°C) Relative density (at 20°C) Water solubility Soluble in Relative vapour density Viscosity Partition coëfficient n-octanol/water Evaporation rate ratio to butyl acetate ratio to ether		N.D. N.A. N.D. O.00007 N.D. 1.3 O.00001 Ether, acet N.D. N.D. 5.61/5.79 N.D. N.D. N.D.	°C °C vol% (°C) hPa hPa g/100 ml one, oils/fats Pa.s
Other information:			
Melting point/melting range Auto-ignition point Saturation concentration	:	160 N.D. N.D.	°C °C g/m ³

Auto-ignition point Saturation concentration 19

Stability and reactivity 10.

9.3

10.1 Conditions to avoid/reactivity: - Stable under normal conditions

10.2 Materials to avoid: - Keep away from: heat sources, ignition sources, oxidizing agents, acids

g/m³

10.3 Hazardous decomposition products:

- Upon combustion CO and CO2 are formed
 Reacts violently with (strong) oxidizers
 Decomposes on exposure to (strong) acids

Toxicological information 11.

11.1 Acute toxicity:

LD50	oral rat	::	N.D.	mg/kg
LD50	dermal rat		N.D.	mg/kg
LC50	dermal rabbit		N.D.	mg/l/4 h
LC50	inhalation rat		N.D.	ppm/4 h
LC50	inhalation rat	:	N.D.	ppm/4 h

11.2 Chronic toxicity:

EC carc. cat. EC muta. cat. EC repr. cat.	::	2 not listed not listed
Carcinogenicity (TLV) Carcinogenicity (MAC) Carcinogenicity (VME) Carcinogenicity (GWBB)	::	A2 K not listed not listed
Carcinogenicity (MAK) Mutagenicity (MAK) Teratogenicity (MAK)	::	2 not listed -
IARC classification	:	2A
11.3 Routes of exposure:		ingestion, inhalation, eyes and skin Caution! Substance is absorbed through the skin
11.4 Acute effects/symptoms:		

11.4 s/symp

AFTER SKIN CONTACT

- Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic
 Mutagenicity: AMES test positive
- Probably human mutagenic

ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: - No specific information available

SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:

- Feeling of weakness
- PhotoallergySkin rash/inflammation
- Cracking of the skin
- Skin cañcer
- Lung tissue affection/degeneration
 Enlargement/affection of the liver
 Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:

0.0018 mg/l (PIMEPHALES PROMELAS) 0.01 mg/l (DAPHNIA PULEX) - LC50 (65 h) : - EC50 (96 h) :

12.2 Mobility:

- Volatile organic compounds (VOC): 0%
- Photolysis in water
 Ozonation in water
 Insoluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- biodegradation BOD₅ % ThOD : N.D.
- water - Not readily biodegradable in water :
- : T ¹/₂: > 100 - soil days

12.4 Bioaccumulative potential: - log P_{ow} : 5.61/5.79 - BCF : 72 h :

- 350 (LEUCISCUS IDUS)
- Highly bioaccumulative

BENZ[a]ANTHRACENE

12.5 Other adverse effects:

- WGK • 3 (Classification based on the R-phrases in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999)
- Effect on the ozone layer
- Greenhouse effect

- : Not dangerous for the ozone layer (Council Regulation (EC) 3093/94)
- : no data available : no data available
- Effect on waste water purification

13. **Disposal considerations**

- 13.1 Provisions relating to waste: Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 16 05 06 (laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory experiences) chemicals)
 - Waste material code (Flanders): 001, 045, 691
 Waste code (Germany): 59302
 Hazardous waste (91/689/EEC)

13.2 Disposal methods:

- Dissolve or mix with a combustible solvent
 Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber
 Do not discharge into surface water (2000/60/EEC, Council Decision 2455/2001/EC)

13.3 Packaging/Container:

Waste material code packaging (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

BENZ[a]ANTHRACENE

14. Transport information



14.1	Classification of the substance in compliance UN number CLASS SUB RISKS PACKING PROPER SHIPPING NAME	• W.	<pre>ith UN Recommendations 3077 9 - III UN 3077, Environmentally hazardous substance, solid, n.o.s. (benzo[a]anthracene)</pre>
14.2	ADR (transport by road) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.3	RID (transport by rail) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.4	ADNR (transport by inland waterways) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.5	IMDG (maritime transport) CLASS SUB RISKS PACKING MFAG EMS MARINE POLLUTANT	: : : : : : : : : : : : : : : : : : : :	9 - III - P
14.6	ICAO (air transport) CLASS SUB RISKS PACKING PACKING INSTRUCTIONS PASSENGER AIRCRAFT PACKING INSTRUCTIONS CARGO AIRCRAFT	:::::::::::::::::::::::::::::::::::::::	9 _ III
14.7	Special precautions in connection with transport	:	none
14.8	Limited quantities (LQ)	:	
	When substances and their packaging meet the ADR/RID/ADNR in chapter 3.4, only the followi complied with: each package shall display a diamond-shaped f inscription: - 'UN 3077' or, in the case of different goods with diffe within a single package: - the letters 'LQ'	co ng ig	nditions established by prescriptions shall be ure with the following nt identification numbers

BENZ[a]ANTHRACENE

15. Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens



Toxic



Dangerous for the
environment

R45 : May cause cancer R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

953	· Avoid exposure - obtain special instructions before use
000	· mora exposure obtain special instructions before use
S45	: In case of accident or if you feel unwell, seek medical advice
	(show the label where possible)
S60	: This material and/or its container must be disposed of as
	hazardous waste
S61	: Avoid release to the environment. Refer to special
	instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

- N.A. = NOT APPLICABLE N.D. = NOT DETERMINED
- N.D. = NOT DETERMINED ★ = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45	:	May cause cancer
R50/53	:	Very toxic to aquatic organisms, may cause long-term adverse effects in the
		aquatic environment

Exposure limits:

TLV	:	Threshold Limit Value - ACGIH USA 2000
OES	:	Occupational Exposure Standards - United Kingdom 1999
MEL	:	Maximum Exposure Limits - United Kingdom 1999
MAK	:	Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK	:	Technische Richtkonzentrationen – Germany 2001
MAC	:	Maximale aanvaarde concentratie - The Netherlands 2002
VME	:	Valeurs limites de Moyenne d'Exposition - France 1999
VLE	:	Valeurs limites d'Exposition à court terme - France 1999
GWBB	:	Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK	:	Grenswaarde kortstondige blootstelling - Belgium 1998
EC	:	Indicative occupational exposure limit values - directive 2000/39/EC

Chronic toxicity:
 K : List of the carcinogenic substances and processes - The Netherlands 2002

Material Safety Data Sheet Benzo[a]pyrene, 98%

ACC# 37175

Section 1 - Chemical Product and Company Identification

MSDS Name: Benzo[a]pyrene, 98%
Catalog Numbers: AC105600000, AC105600010, AC105601000, AC377200000, AC377200010, AC377201000 AC377201000
Synonyms: 3,4-Benzopyrene; 3,4-Benzpyrene; Benzo[def]chrysene.
Company Identification:

Acros Organics N.V.
One Reagent Lane
Fair Lawn, NJ 07410

For information in North America, call: 800-ACROS-01
For emergencies in the US, call CHEMTREC: 800-424-9300

Section 2 - Composition, Information on Ingredients

CAS#	Chemical Name	Percent	EINECS/ELINCS
50-32-8	Benzo[a]pyrene	>96	200-028-5

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Appearance: yellow to brown powder.

Danger! May cause harm to the unborn child. May impair fertility. May cause eye, skin, and respiratory tract irritation. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Cancer hazard. May cause allergic skin reaction. May cause heritable genetic damage.

Target Organs: Reproductive system, skin.

Potential Health Effects

Eye: May cause eye irritation.

Skin: May cause skin irritation. May be harmful if absorbed through the skin. May cause an allergic reaction in certain individuals.

Ingestion: May cause irritation of the digestive tract. The toxicological properties of this substance have not been fully investigated. May be harmful if swallowed.

Inhalation: May cause respiratory tract irritation. The toxicological properties of this substance have not been fully investigated. May be harmful if inhaled.

Chronic: May cause cancer in humans. May cause reproductive and fetal effects. Laboratory experiments have resulted in mutagenic effects.

Section 4 - First Aid Measures

Eyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid.

Skin: Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.

Ingestion: Never give anything by mouth to an unconscious person. Get medical aid. Do NOT induce vomiting. If conscious and alert, rinse mouth and drink 2-4 cupfuls of milk or water. **Inhalation:** Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.

Notes to Physician: Treat symptomatically and supportively.

Section 5 - Fire Fighting Measures

General Information: As in any fire, wear a self-contained breathing apparatus in pressuredemand, MSHA/NIOSH (approved or equivalent), and full protective gear. During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

Extinguishing Media: Use water spray, dry chemical, carbon dioxide, or appropriate foam. **Flash Point:** Not available.

Autoignition Temperature: Not available.

Explosion Limits, Lower:Not available.

Upper: Not available.

NFPA Rating: (estimated) Health: 2; Flammability: 0; Instability: 0

Section 6 - Accidental Release Measures

General Information: Use proper personal protective equipment as indicated in Section 8. **Spills/Leaks:** Clean up spills immediately, observing precautions in the Protective Equipment section. Sweep up, then place into a suitable container for disposal. Avoid generating dusty conditions. Provide ventilation.

Section 7 - Handling and Storage

Handling: Wash thoroughly after handling. Use with adequate ventilation. Minimize dust generation and accumulation. Avoid contact with eyes, skin, and clothing. Keep container tightly closed. Avoid ingestion and inhalation.

Storage: Store in a tightly closed container. Store in a cool, dry, well-ventilated area away from incompatible substances.

Section 8 - Exposure Controls, Personal Protection

Engineering Controls: Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate ventilation to keep airborne concentrations low.

Exposure Limits

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs	

Benzo[a]pyrene	0.2 mg/m3 TWA (as	0.1 mg/m3 TWA (cyclohexane-extractable	0.2 mg/m3 TWA (as
	listed under Coal tar pitches).	tar pitches).80 mg/m3 IDLH (listed under Coal tar	(listed under Coal tar pitches).
		pitches).	

OSHA Vacated PELs: Benzo[a]pyrene: No OSHA Vacated PELs are listed for this chemical. **Personal Protective Equipment**

Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166. **Skin:** Wear appropriate protective gloves to prevent skin exposure.

Clothing: Wear appropriate protective clothing to prevent skin exposure.

Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements or European Standard EN 149 must be followed whenever workplace conditions warrant respirator use.

Section 9 - Physical and Chemical Properties

Physical State: Powder Appearance: yellow to brown Odor: faint aromatic odor pH: Not available. Vapor Pressure: Not available. Vapor Density: Not available. Viscosity: Not available. Viscosity: Not available. Boiling Point: 495 deg C @ 760 mm Hg Freezing/Melting Point:175 - 179 deg C Decomposition Temperature:Not available. Solubility: 1.60x10-3 mg/l @25°C Specific Gravity/Density:Not available. Molecular Formula:C20H12 Molecular Weight:252.31

Section 10 - Stability and Reactivity

Chemical Stability: Stable under normal temperatures and pressures. **Conditions to Avoid:** Dust generation.

Incompatibilities with Other Materials: Strong oxidizing agents. Hazardous Decomposition Products: Carbon monoxide, carbon dioxide. Hazardous Polymerization: Has not been reported.

Section 11 - Toxicological Information

RTECS#: CAS# 50-32-8: DJ3675000 LD50/LC50: Not available.

Carcinogenicity:

CAS# 50-32-8:

- ACGIH: A2 Suspected Human Carcinogen
- California: carcinogen, initial date 7/1/87
- NTP: Suspect carcinogen
- **IARC:** Group 1 carcinogen (listed as Coal tar pitches).

Epidemiology: No information found **Teratogenicity:** No information found **Reproductive Effects:** Adverse reproductive effects have occurred in experimental animals. **Mutagenicity:** Mutagenic effects have occurred in humans.Mutagenic effects have occurred in experimental animals. **Neurotoxicity:** No information found

Other Studies:

Section 12 - Ecological Information

No information available.

Section 13 - Disposal Considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. US EPA guidelines for the classification determination are listed in 40 CFR Parts 261.3. Additionally, waste generators must consult state and local hazardous waste regulations to ensure complete and accurate classification.

RCRA P-Series: None listed.

RCRA U-Series:

CAS# 50-32-8: waste number U022.

Section 14 - Transport Information

	US DOT	Canada TDG
Shipping Name:	NOT REGULATED FOR DOMESTIC TRANSPORT	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOL (Benzo{a} pyrene)
Hazard Class:		9
UN Number:		UN3077
Packing Group:		III

Section 15 - Regulatory Information

US FEDERAL

TSCA

CAS# 50-32-8 is listed on the TSCA inventory.

Health & Safety Reporting List

None of the chemicals are on the Health & Safety Reporting List.

Chemical Test Rules

None of the chemicals in this product are under a Chemical Test Rule.

Section 12b

None of the chemicals are listed under TSCA Section 12b.

TSCA Significant New Use Rule

None of the chemicals in this material have a SNUR under TSCA.

CERCLA Hazardous Substances and corresponding RQs CAS# 50-32-8: 1 lb final RQ; 0.454 kg final RQ

SARA Section 302 Extremely Hazardous Substances

None of the chemicals in this product have a TPQ.

SARA Codes

CAS # 50-32-8: immediate, delayed.

Section 313

This material contains Benzo[a]pyrene (CAS# 50-32-8, >96%), which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR

Clean Air Act:

This material does not contain any hazardous air pollutants.

This material does not contain any Class 1 Ozone depletors.

This material does not contain any Class 2 Ozone depletors.

Clean Water Act:

None of the chemicals in this product are listed as Hazardous Substances under the CWA. CAS# 50-32-8 is listed as a Priority Pollutant under the Clean Water Act.

None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

OSHA:

None of the chemicals in this product are considered highly hazardous by OSHA.

STATE

CAS# 50-32-8 can be found on the following state right to know lists: California, New Jersey, Pennsylvania, Minnesota, Massachusetts.

California Prop 65

The following statement(s) is(are) made in order to comply with the California Safe Drinking Water Act:

WARNING: This product contains Benzo[a]pyrene, a chemical known to the state of California to cause cancer.

California No Significant Risk Level: CAS# 50-32-8: 0.06 æg/day NSRL

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols:

ΤN

Risk Phrases:

- R 43 May cause sensitization by skin contact.
- R 45 May cause cancer.
- R 46 May cause heritable genetic damage.
- R 60 May impair fertility.
- R 61 May cause harm to the unborn child.
- R 50/53 Very toxic to aquatic organisms, may cause long-term
- adverse effects in the aquatic environment.

Safety Phrases:

S 45 In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

S 53 Avoid exposure - obtain special instructions before use.

S 60 This material and its container must be disposed of as hazardou s waste.

S 61 Avoid release to the environment. Refer to special instructions /safety data sheets.

WGK (Water Danger/Protection)

CAS# 50-32-8: No information available.

Canada - DSL/NDSL

CAS# 50-32-8 is listed on Canada's DSL List.

Canada - WHMIS

This product has a WHMIS classification of D2A.

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

Canadian Ingredient Disclosure List

CAS# 50-32-8 is listed on the Canadian Ingredient Disclosure List.

Section 16 - Additional Information

MSDS Creation Date: 9/02/1997 **Revision #7 Date:** 6/30/2006

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall Fisher be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential or exemplary damages, howsoever arising, even if Fisher has been advised of the possibility of such damages.



SAFETY DATA SHEET

AC105550000; AC105550050; AC105550250; AC105551000

Revision Date 10-Feb-2015

Revision Number 1

1. Identification

Product Name Benzo[ghi]perylene

Cat No. :

Synonyms 1,12-Benzoperylene

Recommended Use Laboratory chemicals.

Uses advised against No Information available Details of the supplier of the safety data sheet

Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100 Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410

Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

Classification under 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Label Elements

None required

Hazards not otherwise classified (HNOC)

Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component		CAS-No	Weight %		
	Benzo(ghi)perylene	191-24-2	> 98		
4. First-aid measures					
Eye Contact	ntact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.				
Skin Contact	Wash off imn clothes and s	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.			

Inhalation	Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Obtain medical attention.
Ingestion	Clean mouth with water. Get medical attention.
Most important symptoms/effects Notes to Physician	No information available. Treat symptomatically

5. Fire-fighting measures

Unsuitable Extinguishing Media	No information available
Flash Point Method -	No information available No information available
Autoignition Temperature Explosion Limits	No information available
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO2)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health 0	Flammability 0	Instability 0	Physical hazards N/A			
	6. Accidental re	elease measures				
Personal Precautions Environmental Precautions	Ensure adequate ventilati See Section 12 for addition Collect spillage.	Ensure adequate ventilation. Use personal protective equipment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.				
Methods for Containment and Cle Up	Methods for Containment and Clean Avoid dust formation. Sweep up or vacuum up spillage and collect in suitable container for disposal. Do not let this chemical enter the environment.					
	7. Handling	and storage				
Handling	Avoid contact with skin ar	nd eyes. Do not breathe dust. Do	o not breathe vapors or spray mist.			
Storage	Keep in a dry, cool and w	ell-ventilated place. Keep contai	ner tightly closed.			
8. [Exposure controls	/ personal protection	on			
Exposure Guidelines	This product does not cor established by the region	ntain any hazardous materials w specific regulatory bodies.	ith occupational exposure limits			
Engineering Measures	Ensure adequate ventilati	on, especially in confined areas				
Personal Protective Equipment						

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Yellow
Odor	Odorless
Odor Threshold	No information available
рН	No information available
Melting Point/Range	276 - 280 °C / 528.8 - 536 °F
Boiling Point/Range	No information available > @ 760 mmHg
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	No information available
Relative Density	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C22 H12
Molecular Weight	276.33

10. Stability and reactivity

Reactive Hazard	None known, based on information available		
Stability	Stable.		
Conditions to Avoid	Excess heat. Exposure to light. Incompatible products.		
Incompatible Materials	Strong oxidizing agents		
Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO2)			
Hazardous Polymerization	Hazardous polymerization does not occur.		
Hazardous Reactions None under normal processing.			
	11. Toxicological information		
Acute Toxicity			
Product Information	No acute toxicity information is available for this product		

No information available

Products Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Benzo(ghi)perylene	191-24-2	Not listed	Not listed	Not listed	Not listed	Not listed
Mutagenic Effects		No information ava	ailable	•	-	
Reproductive Effect	s	No information ava	ailable.			
Developmental Effe	cts	No information ava	ailable.			
Teratogenicity		No information available.				
STOT - single expos STOT - repeated ex	sure posure	None known None known				
Aspiration hazard		No information ava	ailable			
Symptoms / effects	,both acute and	No information ava	ailable			
Endocrine Disrupto	r Information	No information ava	ailable			
Other Adverse Effe	cts	The toxicological p complete informat	properties have not	t been fully investig	gated. See actual e	entry in RTECS for

12. Ecological information

Ecotoxicity

Do not empty into drains.

Persistence and Degradability	l
Bioaccumulation/ Accumulation	1

No information available No information available.

.

Mobility

Component	log Pow
Benzo(ghi)perylene	7.23

	13. Disposal considerations
Vaste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

	14. Transport information
DOT	Not regulated
TDG	Not regulated
ΙΑΤΑ	Not regulated
IMDG/IMO	Not regulated
	15 Desculatory information

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL

Benzo(ghi)perylene	-	-	-	205-883-8	-	-	-	-	-	-
a second										

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Benzo(ghi)perylene	191-24-2	> 98	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Benzo(ghi)perylene	-	-	Х	Х

Clean Air Act

Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs		
Benzo(ghi)perylene	5000 lb	-		

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Benzo(ghi)perylene	Х	Х	Х	Х	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class	Non-controlled
	16. Other information
Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Revision Date Print Date	10-Feb-2015 10-Feb-2015
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 01-May-2012	Revision Date 23-Jan-2015	Revision Number 2
	1. Identification	
Product Name	Benzoic acid	
Cat No. :	A63-500; A65-500; A68-30	
Synonyms	Benzenecarboxylic acid; Benzenemethanoic acid; Phenylcarboxylic acid; Phenylformic acid; Benzeneformic acid; Carboxybenzene	
Recommended Use	Laboratory chemicals.	
Uses advised against Details of the supplier of the sat	No Information available tety data sheet	
Company Fisher Scientific	Emergency Telephone Number	

Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100 Emergency Telephone Number CHEMTREC®, Inside the USA: 800-424-9300 CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation Serious Eye Damage/Eye Irritation Specific target organ toxicity - (repeated exposure) Target Organs - Lungs. Category 2 Category 1 Category 1

Label Elements

Signal Word Danger

Hazard Statements Causes skin irritation Causes serious eye damage Causes damage to organs through prolonged or repeated exposure


Precautionary Statements

Prevention

Wash face, hands and any exposed skin thoroughly after handling Wear protective gloves/protective clothing/eye protection/face protection Do not breathe dust/fume/gas/mist/vapors/spray Do not eat, drink or smoke when using this product

Response

Get medical attention/advice if you feel unwell Skin

IF ON SKIN: Wash with plenty of soap and water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing Immediately call a POISON CENTER or doctor/physician

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

May form combustible dust concentrations in air

3. Composition / information on ingredients

Component	CAS-No	Weight %
Benzoic acid	65-85-0	>95

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.	
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.	
Inhalation	Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Obtain medical attention.	
Ingestion	Do not induce vomiting. Obtain medical attention.	
Most important symptoms/effects	Causes eye burns. Repeated or prolonged skin contact may cause allergic reactions with	
Susceptible persons.Notes to PhysicianTreat symptomatically		
	5. Fire-fighting measures	
Suitable Extinguishing Media	Water spray. Carbon dioxide (CO ₂). Dry chemical. chemical foam.	
Unsuitable Extinguishing Media	No information available	
Flash Point Method -	121 °C / 249.8 °F No information available	
Autoignition Temperature Explosion Limits	Not applicable 570 °C / 1058 °F	
Upper	No data available	
Lower	No data available	
Sensitivity to Mechanical Impact	t No information available	
Sensitivity to Static Discharge	No information available	

Specific Hazards Arising from the Chemical Dust can form an explosive mixture in air.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO2)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

<u>NFPA</u> Health 3	Flammability 1	Instability 0	Physical hazards N/A				
	6. Accidental re	elease measures					
Personal Precautions Environmental Precautions	Use personal protective equipment. Ensure adequate ventilation. See Section 12 for additional ecological information.						
Methods for Containment and Clo Up	ean Sweep up or vacuum up s formation.	spillage and collect in suitable co	ontainer for disposal. Avoid dust				
	7. Handling	and storage					
Handling	Avoid contact with skin ar	nd eyes. Avoid ingestion and inh	alation. Do not breathe dust.				
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat and sources of ignition.						
8.	Exposure controls	/ personal protection	on				
Exposure Guidelines	This product does not cor established by the region	ntain any hazardous materials w specific regulatory bodies.	ith occupational exposure limits				
Engineering Measures	Ensure adequate ventilati and safety showers are cl	on, especially in confined areas lose to the workstation location.	. Ensure that eyewash stations				
Personal Protective Equipment							
Eye/face Protection	Wear appropriate protecti OSHA's eye and face pro EN166.	ve eyeglasses or chemical safe tection regulations in 29 CFR 19	ty goggles as described by 010.133 or European Standard				
Skin and body protection	Wear appropriate protecti	ve gloves and clothing to prever	nt skin exposure.				
Respiratory Protection	Follow the OSHA respirat EN 149. Use a NIOSH/M exposure limits are excee	or regulations found in 29 CFR SHA or European Standard EN ded or if irritation or other sympt	1910.134 or European Standard 149 approved respirator if toms are experienced.				
Hygiene Measures	Handle in accordance wit	h good industrial hygiene and sa	afety practice.				
	9. Physical and cl	nemical properties					
Physical State		Solid Off-white					

Appearance Odor **Odor Threshold** рΗ . Melting Point/Range Boiling Point/Range Flash Point

Off-white aromatic No information available 2.5-3.5 2.9 g/l water 121 - 123 °C / 249.8 - 253.4 °F 249 °C / 480.2 °F @ 760 mmHg 121 °C / 249.8 °F

Evaporation Rate Flammability (solid,gas) Flammability or explosive limits Upper Lower Vapor Pressure Vapor Density Relative Density Solubility Partition coefficient; n-octanol/water Autoignition Temperature Decomposition Temperature Viscosity Molecular Formula Molecular Weight Not applicable No information available

No data available No data available 1.3 hPa @ 96 °C Not applicable No information available soluble No data available Not applicable 570 °C / 1058 °F No information available Not applicable C7 H6 O2 122.12

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Avoid dust formation.
Incompatible Materials	Strong acids, Strong bases, Strong oxidizing agents, Strong reducing agents, Metals
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO2)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	Aqueous solution, May react with metals and lead to the formation of flammable hydrogen gas.

11. Toxicological information

Acute Toxicity

Product Information

component morma	lion						
Component		LD50 Oral		LD50 Dermal	LC50	Inhalation	
Benzoic acio	1	1700 mg/kg (Rat) 2565 mg/kg(Rat)		Not listed		n³(Rat)1 h	
Toxicologically Syne Products Delayed and immedi	ergistic ate effects as	No information ava	ilable	id long-term expo	sure_		
Irritation		Irritating to eyes, re	espiratory system	and skin			
Sensitization		No information available					
Carcinogenicity		The table below inc	dicates whether ea	ach agency has lis	ted any ingredient	as a carcinogen.	
Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico	
Benzoic acid	65-85-0	Not listed	Not listed	Not listed	Not listed	Not listed	
Mutagenic Effects		Not mutagenic in AMES Test					
Reproductive Effects	5	No information available.					
Developmental Effect	ts	No information available.					
Teratogenicity		No information available.					

STOT - single exposure STOT - repeated exposure	None known Lungs
Aspiration hazard	No information available
Symptoms / effects,both acute and delayed	No information available
Endocrine Disruptor Information	No information available
Other Adverse Effects	The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Benzoic acid	5 mg/L EC50 = 3 h	180 mg/L LC50 96 h	EC50 = 16.85 mg/L 30 min	300 mg/L EC50 = 24 h 860
	-	-	EC50 = 16.9 mg/L 15 min	mg/L EC50 = 48 h

Persistence and Degradability Bioaccumulation/ Accumulation

Soluble in water Persistence is unlikely based on information available. No information available.

Mobility

Is not likely mobile in the environment due its low water solubility. Will likely be mobile in the environment due to its water solubility.

Component	log Pow
Benzoic acid	1.93

13. Disposal considerations

 Waste Disposal Methods
 Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information		
DOT	Not regulated	
TDG	Not regulated	
ΙΑΤΑ	Not regulated	
IMDG/IMO	Not regulated	
	15 Regulatory information	

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Benzoic acid	Х	Х	-	200-618-2	-		Х	Х	Х	Х	Х

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

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N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable

SARA 313	Not applicable
SARA 311/312 Hazardous (Acute Health Hazard	Categorization
Chasa is Uselik Usera	

Chronic Health Hazard	
Fire Hazard	
Sudden Release of Pressure Hazard	
Reactive Hazard	

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Benzoic acid	Х	5000 lb	-	-
	^ · · · · · · · · · · · · · · · · · · ·		^ · · · · · · · · · · · · · · · · · · ·	

Yes Yes No No No

Clean Air Act Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Benzoic acid	5000 lb	-

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Benzoic acid	Х	Х	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

E Corrosive material D2A Very toxic materials



16. Other information

Prepared By

Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

Creation Date Revision Date Print Date Revision Summary 01-May-2012 23-Jan-2015 23-Jan-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

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End of SDS

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.6 Revision Date 12/29/2015 Print Date 01/29/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Beryllium
	Product Number Brand	:	378135 Aldrich
	CAS-No.	:	7440-41-7

1.2 Relevant identified uses of the substance or mixture and uses advised against

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency telephone nu	mhe	ar .

1.4 Emergency telephone number

Emergency Phone #	:	(314) 776-6555
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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Acute toxicity, Inhalation (Category 2), H330 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Skin sensitisation (Category 1), H317 Carcinogenicity (Category 1B), H350 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Specific target organ toxicity - repeated exposure (Category 1), H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H301	Toxic if swallowed.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H350	May cause cancer.

H372	Causes damage to organs through prolonged or repeated exposure.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P272	Contaminated work clothing should not be allowed out of the workplace.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
P284	Wear respiratory protection
P_{204}	IE SWALLOWED: Immediately call a POISON CENTER or doctor/
F 301 + F 310 + F 330	physician. Rinse mouth.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P333 + P313	If skin irritation or rash occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Be
Molecular weight	:	9.01 g/mol
CAS-No.	:	7440-41-7
EC-No.	:	231-150-7

Hazardous components

Component	Classification	Concentration
Berylium foil		
	Acute Tox. 3; Acute Tox. 2; Skin Irrit. 2; Eye Irrit. 2A; Skin Sens. 1; Carc. 1B; STOT SE 3; STOT RE 1; H301, H315, H317, H319, H330, H335, H350, H372	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2 Most important symptoms and effects, both acute and delayed** The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Beryllium oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

- 6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.
- 6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place. Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Bervlium foil	7440-41-7	TWA	2 000000	USA Occupational Exposure Limits
Dorynam fon			mg/m3	(OSHA) - Table Z-2
		CEII	5 00000	USA Occupational Exposure Limits
			ma/m3	(OSHA) - Table Z-2
		Peak	25.000000	USA, Occupational Exposure Limits
			ma/m3	(OSHA) - Table Z-2
		TWA	2.000000microg	USA, Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
	Remarks	Z27.29-1970)	
		CEIL	5.000000microg	USA. Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	
		Peak	25.000000micro	USA. Occupational Exposure Limits
			gram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	·
		TWA	0.000050	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
		Beryllium se	nsitization	•••
		Chronic bery	/Ilium disease (ber	ylliosis)
		Confirmed h	uman carcinogen	
		Danger of cu	utaneous absorptio	n
		Sensitizer	-	
		С	0.000500	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Potential Oc	cupational Carcino	gen
		See Append	ix A	
		See Table Z	-2	
		TWA	2.000000microg	USA. Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	
		TWA	2.000000microg	USA. Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	
		CEIL	5.000000microg	USA. Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	
		CEIL	5.000000microg	USA. Occupational Exposure Limits
			ram per cubic	(OSHA) - Table Z-2
			meter	
		Z27.29-1970)	
		Peak	25.000000micro	USA. Occupational Exposure Limits
			gram per cubic	(USHA) - Table Z-2
			meter	
		Z27.29-1970)	
		Peak	25.000000micro	USA. Occupational Exposure Limits
			gram per cubic	(USHA) - Table Z-2
			meter	
		Z27.29-1970)	
		TWA	0.000050	USA. ACGIH Threshold Limit Values
		_	mg/m3	(TLV)
		Beryllium se	nsitization	

Chronic beryllium disease (berylliosis) Adopted values or notations enclosed are those for which changes are proposed in the NIC See Notice of Intended Changes (NIC) Confirmed human carcinogen Danger of cutaneous absorption Sensitizer			
С	0.000500	USA. NIOSH Recommended	
	mg/m3	Exposure Limits	
Potential Occupational Carcinogen			
See Appendix A			
See Table Z-2			
TWA	2microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
Z27.29-1970			
CEIL	5microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
Z27.29-1970			
Peak	25microgram per cubic meter	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
Z27.29-1970			
С	0.0005 mg/m3	USA. NIOSH Recommended Exposure Limits	
Potential Occupational Carcinogen See Appendix A			

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	odourless
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 1,278 °C (2,332 °F) - lit.
f)	Initial boiling point and boiling range	2,970 °C (5,378 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	1.85 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	ner safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

10.2 Chemical stability Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions No data available

9.2

10.4 Conditions to avoid No data available

- **10.5** Incompatible materials Alkali metals
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

LD50 Intravenous - Rat - 0.496 mg/kg Remarks: Liver:Hepatitis (hepatocellular necrosis), zonal.

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity Hamster Lungs

Result: negative

Carcinogenicity

Carcinogenicity - Rat - Intratracheal Tumorigenic:Neoplastic by RTECS criteria. Lungs, Thorax, or Respiration:Tumors. Lungs, Thorax, or Respiration:Bronchiogenic carcinoma.

Carcinogenicity - Rabbit - Intravenous Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Musculoskeletal:Tumors.

Possible human carcinogen

IARC: 1 - Group 1: Carcinogenic to humans (Berylium foil)

NTP: Known to be human carcinogen (Berylium foil)

Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Berylium foil)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available No data available

Additional Information

RTECS: DS1750000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

	UN number: 1567 Proper shipping name: Reportable Quantity (R	Class: 6.1 (4.1) Beryllium, powder RQ): 10 lbs	Packing group: II	
	Poison Inhalation Haza	ard: No		
	IMDG UN number: 1567 Proper shipping name:	Class: 6.1 (4.1) BERYLLIUM POWDER	Packing group: II	EMS-No: F-G, S-G
	IATA UN number: 1567 Proper shipping name:	Class: 6.1 (4.1) Beryllium powder	Packing group: II	
D				

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

CAS-No.	Revision Date
7440-41-7	1993-04-24

SARA 311/312 Hazards

Berylium foil

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Berylium foil	CAS-No. 7440-41-7	Revision Date 1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Berylium foil	7440-41-7	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Berylium foil	/440-41-/	1993-04-24
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Berylium foil	7440-41-7	2008-10-10

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H301	Toxic if swallowed.
H315	Causes skin irritation.
H317	May cause an allergic skin reaction.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H350	May cause cancer.
H372	Causes damage to organs through prolonged or repeated exposure.
Skin Irrit.	Skin irritation
Skin Sens.	Skin sensitisation

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0
NFPA Rating	

Health hazard:	4
Fire Hazard:	3
Reactivity Hazard:	3

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.11 Revision Date 06/18/2015 Print Date 02/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Bis(2-ethylhexyl) phthalate		
	Product Number Brand Index-No.	::	80030 Sigma-Aldrich 607-317-00-9		
	CAS-No.	:	117-81-7		
1.2	Relevant identified uses of the substance or mixture and uses advised against				
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		
1 /	Emergency telephone nu	mho	r		

1.4 Emergency telephone number

Emergency Phone #	: ((314) 776-6555
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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS) Reproductive toxicity (Category 1B), H360

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s) H360	May damage fertility or the unborn child.
Precautionary statement(s)	Obtain special instructions before use
P201	Do not handle until all cofety presentions have been read and
F202	understood.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Endocrine disrupting chemical(s)

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	'Dioctyl' phthalate Phthalic acid bis(2-ethylhexyl ester) DEHP
Formula	:	C ₂₄ H ₃₈ O ₄
Molecular weight	:	390.56 g/mol
CAS-No.	:	117-81-7
EC-No.	:	204-211-0
Index-No.	:	607-317-00-9
Registration number	:	01-2119484611-38-XXXX

Hazardous components

Component	Classification	Concentration
bis(2-Ethylhexyl) phthalate Included in the Candidate I according to Regulation (EC) No. 1907/2006 (REACH)	ist of Substances of Very High C	Concern (SVHC)
	Repr. 1B; H360	<= 100 %
For the full text of the H-Statements mentioned in this Se	ection, see Section 16.	

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures
 Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas.
 For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
bis(2-Ethvlhexvl)	117-81-7	TWA	5.000000	USA. ACGIH Threshold Limit Values
phthalate			mg/m3	(TLV)
	Remarks	Lower Respiratory Tract irritation		
		Confirmed animal carcinogen with unknown relevance to humans		
		TWA	5.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Potential Occupational Carcinogen		
		See Appendi	ix A	-
		ST	10.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Potential Occupational Carcinogen		gen
		See Appendix A		
		TWA	5.000000	USA. Occupational Exposure Limits
			ing/ine	Contaminants

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 480 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 230 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	-50.0 °C (-58.0 °F)
f)	Initial boiling point and boiling range	386 °C (727 °F) - lit.
g)	Flash point	207.0 °C (404.6 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Lower explosion limit: 0.3 %(V)
k)	Vapour pressure	1.6 hPa (1.2 mmHg) at 93.0 °C (199.4 °F)
I)	Vapour density	No data available
m)	Relative density	0.985 g/cm3 at 20 °C (68 °F)
n)	Water solubility	insoluble

o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	390.0 °C (734.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Other safety information No data available		

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- 10.2 Chemical stability Stable under recommended storage conditions.
- 10.3 Possibility of hazardous reactions No data available
- 10.4 Conditions to avoid No data available
- 10.5 Incompatible materials Strong oxidizing agents
- 10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity LD50 Oral - Rat - 30,000 mg/kg

Inhalation: No data available

LD50 Dermal - Rabbit - 25,000 mg/kg

No data available

Skin corrosion/irritation Skin - Rabbit Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation Eyes - Rabbit Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation Maximisation Test (GPMT) - Guinea pig Result: Does not cause skin sensitisation. (OECD Test Guideline 406)

Germ cell mutagenicity No data available

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification. Sigma-Aldrich - 80030

- IARC. 2B - Group 2B: Possibly carcinogenic to humans (bis(2-Ethylhexyl) phthalate)
- NTP: Reasonably anticipated to be a human carcinogen (bis(2-Ethylhexyl) phthalate)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

May cause congenital malformation in the fetus. Presumed human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information RTECS: TI0350000

Effects due to ingestion may include:, Gastrointestinal disturbance

Kidney -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

	Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - > 0.67 mg/l - 96 h	
		LC50 - Oncorhynchus mykiss (rainbow trout) - > 0.32 mg/l - 96 h	
		LC50 - Cyprinodon variegatus (sheepshead minnow) - > 0.17 mg/l - 96 h	
		LC50 - Lepomis macrochirus (Bluegill) - > 0.20 mg/l - 96 h	
		NOEC - other fish - > 0.3 mg/l - 96 h	
	Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - > 0.16 mg/l - 48 h	
12.2	Persistence and degrad Biodegradability	lability Result: - Readily biodegradable (OECD Test Guideline 301)	
12.3	Bioaccumulative potential		
	Bioaccumulation	Oncorhynchus mykiss (rainbow trout) - 100 d - 0.014 mg/l	
		Bioconcentration factor (BCF): 113 Remarks: Does not bioaccumulate.	

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3082 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (bis(2-Ethylhexyl) phthalate) Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

ΙΑΤΑ

Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components	are subject to reporting	levels established by SAR	A Title III, Section 313:

	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01
SARA 311/312 Hazards Chronic Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
bis(2-Ethylhexyl) phthalate	117-81-7	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	117-81-7	2009-02-01
bis(2-Ethylhexyl) phthalate		
WARNING: This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause birth defects or other reproductive	117-81-7	2009-02-01
harm.		
bis(∠-Ethyinexyi) phthalate		

Sigma-Aldrich - 80030

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

H360	May damage fertility or the unborn child.
Repr.	Reproductive toxicity

HMIS Rating

-	
Health hazard:	0
Chronic Health Hazard:	*
Flammability:	1
Physical Hazard	0

NFPA Rating

Health hazard:	0
Fire Hazard:	1
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.11

Revision Date: 06/18/2015

Print Date: 02/11/2016



Health	3
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Cadmium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Cadmium Catalog Codes: SLC3484, SLC5272, SLC2482 CAS#: 7440-43-9 RTECS: EU9800000 TSCA: TSCA 8(b) inventory: Cadmium Cl#: Not applicable. Synonym: Chemical Name: Cadmium

Chemical Formula: Cd

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Cadmium	7440-43-9	100

Toxicological Data on Ingredients: Cadmium: ORAL (LD50): Acute: 2330 mg/kg [Rat.]. 890 mg/kg [Mouse]. DUST (LC50): Acute: 50 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer), of eye contact (irritant). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to kidneys, lungs, liver. Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact: No known effect on eye contact, rinse with water for a few minutes.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 570°C (1058°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Non-flammable in presence of open flames and sparks, of heat, of oxidizing materials, of reducing materials, of combustible materials, of moisture.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Material in powder form, capable of creating a dust explosion. When heated to decomposition it emits toxic fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Keep container dry. Keep in a cool place. Ground all equipment containing material. Keep container tightly closed. Keep in a cool, well-ventilated place. Highly toxic or infectious materials should be stored in a separate locked safety storage cabinet or room.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.01 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 112.4 g/mole

Color: Silvery.

pH (1% soln/water): Not applicable.

Boiling Point: 765°C (1409°F)

Melting Point: 320.9°C (609.6°F)

Critical Temperature: Not available.

Specific Gravity: 8.64 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity: Reacts violently with potassium.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 890 mg/kg [Mouse]. Acute toxicity of the dust (LC50): 229.9 mg/m3 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A2 (Suspected for human.) by ACGIH, 2 (Reasonably anticipated.) by NTP. The substance is toxic to kidneys, lungs, liver.

Other Toxic Effects on Humans:

Hazardous in case of ingestion, of inhalation. Slightly hazardous in case of skin contact (irritant, sensitizer).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: An allergen. 0047 Animal: embryotoxic, passes through the placental barrier.

Special Remarks on other Toxic Effects on Humans: May cause allergic reactions, exzema and/or dehydration of the skin.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the original product.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification:

Identification:

Special Provisions for Transport:

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Cadmium California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Cadmium Pennsylvania RTK: Cadmium Massachusetts RTK: Cadmium TSCA 8(b) inventory: Cadmium SARA 313 toxic chemical notification and release reporting: Cadmium CERCLA: Hazardous substances.: Cadmium

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R26- Very toxic by inhalation. R45- May cause cancer.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 1

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References:

-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Liste des produits purs tératogènes, mutagènes, cancérogènes. Répertoire toxicologique de la Commission de la Santé et de la Sécurité du Travail du Québec. -Material safety data sheet emitted by: la Commission de la Santé et de la Sécurité du Travail du Québec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 04:29 PM

Last Updated: 11/01/2010 12:00 PM

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Calcium

MSDS# 03840

Section 1 - Chemical Product and Company Identification

MSDS Name:	Calcium		
Catalog Numbers:	AC201180000, AC201180050, AC201181000, AC201185000, AC201380000, AC201381000 AC201381000, AC201385000, AC318100000, AC318100050, AC365740000, AC365741000 AC365741000, AC365745000		
Synonyms:	Calcium metal, tu	urnings, crystals, granular; C	alcicat.
Company Id	lentification:		Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410
For informa	tion in the US, call:		201-796-7100
Emergency	Number US:		201-796-7100
CHEMTRI	EC Phone Number,	US:	800-424-9300
		Section 2 - Compositio	n, Information on Ingredients
CAS#:			
Chemical Nar	ne:	Calcium	
%:		99+	
EINECS#:		231-179-5	
H	 Iazard Symbols:	 F	
ŀ	Risk Phrases:	15	
		Section 3 - H	azards Identification
		EMERGEN	CY OVERVIEW
Danger! I	Flammable solid. Car Targ	uses burns by all exposure r et Organs: Respiratory syste	routes. Contact with water liberates extremely flammable gases. em, gastrointestinal system, eyes, skin.
Potential He	ealth Effects		
Eye:	Causes eye burn	ns.	
Skin:	Skin: Causes skin burns. May be harmful if absorbed through the skin.		
Ingestion:	estion: Causes gastrointestinal tract burns. May be harmful if swallowed.		
Inhalation:	Inhalation: Causes chemical burns to the respiratory tract. May be harmful if inhaled.		
Chronic:	No information	found.	
		Section 4 - I	First Aid Measures
Eyes:	Lyes: Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. Get medical aid immediately.		
Claim	Get medical aid in	nmediately. Immediately flux	sh skin with plenty of water for at least 15 minutes while removing

Skin: Contaminated clothing and shoes.

Ingestion: Do not induce vomiting. Get medical aid immediately. Call a poison control center.

Get medical aid immediately. Remove from exposure and move to fresh air immediately. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance;

Inhalation:	induce artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device.
Notes to Physician:	
	Section 5 - Fire Fighting Measures
General Information:	As in any fire, wear a self-contained breathing apparatus in pressure-demand, MSHA/NIOSH (approved or equivalent), and full protective gear. Will burn if involved in a fire. Water reactive. Material will react with water and may release a flammable and/or toxic gas. Flammable solid.
Extinguishing Media:	Use foam, dry chemical, or carbon dioxide. DO NOT USE WATER!
Autoign Tempera	ition ture:
Flash P	oint: Not applicable.
Explosion Li Lo	mits: Not available wer:
Explosion Li UI	mits: pper: Not available
NFPA Ra	ting: ; Special Hazard: -W-
	Section 6 - Accidental Release Measures
General Information:	Use proper personal protective equipment as indicated in Section 8.
 Vacuum or sweep up material and place into a suitable disposal container. Wear a self contained breathing apparatus and appropriate personal protection. (See Exposure Controls, Personal Protection section). Spills/Leaks: Avoid generating dusty conditions. Remove all sources of ignition. Use a spark-proof tool. Do not expose spill to water. Place under an inert atmosphere. Do not get water inside containers. Do not let this chemical enter the environment. 	
	Section 7 - Handling and Storage
Do Handling: Acc Ke	not allow water to get into the container because of violent reaction. Minimize dust generation and sumulation. Use spark-proof tools and explosion proof equipment. Do not get in eyes, on skin, or on clothing. ep away from heat, sparks and flame. Do not ingest or inhale. Handle under an inert atmosphere. Do not allow

- contact with water. Use only in a chemical fume hood.Storage: Keep away from sources of ignition. Store in a cool, dry place. Store in a tightly closed container. Water free
- area. Store protected from moisture. Store under an inert atmosphere.

S	ection 8 -	Exposure Controls,	Personal Prote	ection

+	+	+	+ +
Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
Calcium	none listed	none listed	none listed
+	+	+	++

OSHA Vacated PELs: Calcium: None listed

Engineering Controls:

Use explosion-proof ventilation equipment. Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use only under a chemical fume hood.

Exposure Limits

Personal Protective Equipment

- Eyes: Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
- Skin: Wear appropriate protective gloves to prevent skin exposure.
- Clothing: Wear appropriate protective clothing to prevent skin exposure.

Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a Respirators: NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if

irritation or other symptoms are experienced.

		Section 9 - Physical and Chemical Properties
		Physical State: Solid
		Color: grey
		Odor: none reported
		pH: 14 (4g/L aq.sol.)
		Vapor Pressure: 13 mbar @ 983 deg C
		Vapor Density: Not available
		Evaporation Rate: Not available
		Viscosity: Not available
		Boiling Point: 1484 deg C @ 760 mmHg (2,703.20°F)
		Freezing/Melting Point: 845 deg C (1,553.00°F)
		Decomposition Temperature: Not available
		Solubility in water: Reacts
		Specific Gravity/Density: Not available.
		Molecular Formula: Ca
		Molecular Weight: 40.07
		Section 10 - Stability and Reactivity
	Chemical Stability:	Reacts with water. Water contact produces hydrogen gas.
	Conditions to Avoid:	Incompatible materials, ignition sources, dust generation, excess heat, exposure to moist air or water.
	Incompatibilities with Materials	Other Strong oxidizing agents, acids, alcohols, ammonia, halogens, sulfur, oxygen, phosphorus oxide mercury, alkali hydroxides, metal oxides, alkali halides, nitrogen oxide.
	Hazardous Decompos Products	ition Hydrogen gas.
	Hazardous Polymeriza	tion Has not been reported.
		Section 11 - Toxicological Information
	RTECS#: 0	CAS# 7440-70-2: EV8500000
	LD50/LC50: H	RTECS: Not available.
	Carcinogenicity: 0	Calcium - Not listed as a carcinogen by ACGIH, IARC, NTP, or CA Prop 65.
	Other:	ee actual entry in RTECS for complete information.
		Section 12 - Ecological Information
	Other:	Do not empty into drains.
		Section 13 - Disposal Considerations
	Dispose of in a manne	r consistent with federal, state, and local regulations.
	1	Section 14 - Transport Information
US	S DOT	
Sh	hipping Name: CALCI	JM
Ha	azard Class: 4.3	
UI Po	N Number: UN1401	
ra Ca	anada TDG	

Shipping Name: CALCIUM Hazard Class: 4.3 UN Number: UN1401 Packing Group: II

Section 15 - Regulatory Information

European/International Regulations European Labeling in Accordance with EC Directives Hazard Symbols: F

Risk Phrases:

R 15 Contact with water liberates extremely flammable gases.

Safety Phrases:

S 8 Keep container dry.

S 24/25 Avoid contact with skin and eyes.

S 43C In case of fire, use limestone powder, sodium chloride or dry sand (never use water).

WGK (Water Danger/Protection)

CAS# 7440-70-2: 1

Canada

CAS# 7440-70-2 is listed on Canada's DSL List

Canadian WHMIS Classifications: E, B6

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 7440-70-2 is not listed on Canada's Ingredient Disclosure List.

US Federal

TSCA

CAS# 7440-70-2 is listed on the TSCA Inventory.

Section 16 - Other Information MSDS Creation Date: 5/19/1999 Revision #7 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantibility or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.

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SAFETY DATA SHEET

Version 3.8 Revision Date 10/12/2015 Print Date 01/29/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Carbazole
	Product Number Brand	:	C5132 Sigma
	CAS-No.	:	86-74-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
	:	+1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Carcinogenicity (Category 2), H351 Chronic aquatic toxicity (Category 4), H413

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Warning
Hazard statement(s) H351 H413	Suspected of causing cancer. May cause long lasting harmful effects to aquatic life.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₁₂ H ₉ N
Molecular weight	:	167.21 g/mol
CAS-No.	:	86-74-8
EC-No.	:	201-696-0

Hazardous components

Component	Classification	Concentration
Carbazole		
	Carc. 2; Aquatic Chronic 4;	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Nitrogen oxides (NOx)

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: beige
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 243 - 246 °C (469 - 475 °F)
f)	Initial boiling point and boiling range	355 °C (671 °F)
g)	Flash point	220.0 °C (428.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	The product is not flammable.
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	533 hPa (400 mmHg) at 323 °C (613 °F)
I)	Vapour density	No data available
m)	Relative density	1.1 g/cm3 at 18 °C (64 °F)
n)	Water solubility	0.00091 g/l at 25 °C (77 °F)
o)	Partition coefficient: n- octanol/water	log Pow: 3.72 at 22 °C (72 °F)
p)	Auto-ignition temperature	> 600 °C (> 1,112 °F) at 1,013 hPa (760 mmHg)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Other safety information No data available		

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

9.2

10.2 Chemical stability

Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD0 Oral - Rat - > 16,000 mg/kg (OECD Test Guideline 401)

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

Skin - Rabbit Result: No skin irritation (OECD Test Guideline 404)

Serious eye damage/eye irritation Eyes - Rabbit Result: No eye irritation

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

Carcinogenicity - Mouse - male and female - Oral hepatocellular carcinoma

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Carbazole)

- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: FE3150000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - > 0.93 mg/l - 96.0 h Remarks: No toxicity at the limit of solubility			
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 2.30 - 4.90 mg/l - 48 h Remarks: No toxicity at the limit of solubility			
Toxicity to algae	Growth inhibition NOEC - Scenedesmus acuminatus - > 0.4 mg/l - 96 h Remarks: No toxicity at the limit of solubility			

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential **Bioaccumulation**

Cyprinus carpio (Carp) - 42 d - 0.05 mg/l

Bioconcentration factor (BCF): 241 Cyprinus carpio (Carp) - 42 d - 0.005 mg/l

Bioconcentration factor (BCF): 200

Mobility in soil 12.4

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) Not dangerous goods

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Carbazole) Marine pollutant:yes IATA UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Carbazole)

Further information

EHS-Mark required (ADR 2.2.9.1.10, IMDG code 2.10.3) for single packagings and combination packagings containing inner packagings with Dangerous Goods > 5L for liquids or > 5kg for solids.

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
Carbazole	86-74-8	2009-07-17
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Carbazole	86-74-8	2009-07-17
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer.	86-74-8	2007-09-28
Carbazole		

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

LIMIC Dating	
H413	May cause long lasting harmful effects to aquatic life.
H351	Suspected of causing cancer.
Carc.	Carcinogenicity
Aquatic Chronic	Chronic aquatic toxicity

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	0
Reactivity Hazard:	0
Health hazard:	2
Fire Hazard:	1
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.8

Revision Date: 10/12/2015

Print Date: 01/29/2016

SIGMA-ALDRICH

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SAFETY DATA SHEET

Version 5.6 Revision Date 12/10/2015 Print Date 02/09/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers				
	Product name	:	Carbon disulfide		
	Product Number	:	180173		
	Brand	:	Sigma-Aldrich		
	Index-No.	:	006-003-00-3		
	CAS-No.	:	75-15-0		
1.2	Relevant identified use	s of th	e substance or mixture and uses advised against		

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Acute toxicity, Inhalation (Category 4), H332 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Reproductive toxicity (Category 2), H361 Specific target organ toxicity - repeated exposure, Inhalation (Category 1), H372 Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.

H401	Toxic to aquatic life.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and
	understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
	protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing.
D004 - D040 - D040	Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for
	breathing. Call a POISON CENTER or doctor/ physician if you feel
	UNWEII.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
D000 - D040	contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
$P_{332} + P_{313}$	If skin initiation occurs: Get medical advice/ attention.
P337 + P313	Take off contemported elething and week before revea
P362	Take oil contaminated clothing and wash before reuse.
F370 + F376	extinguish
P403 + P235	Store in a well-ventilated place. Keen cool
P405	Store locked up
P501	Dispose of contents/ container to an approved waste disposal plant
1 301	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

:	CS ₂
:	76.14 g/mol
:	75-15-0
:	200-843-6
:	006-003-00-3
	: :

Hazardous components

Component Classification (Concentration
Carbon disulphide		
	Flam. Liq. 2; Acute Tox. 4;	<= 100 %
	Skin Irrit. 2; Eye Irrit. 2A; Repr.	
	2; STOT RE 1; Aquatic Acute	
	2; H225, H315, H319, H332,	
	H361, H372, H401	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture

Carbon oxides, Sulphur oxides

Flash back possible over considerable distance., Container explosion may occur under fire conditions., Vapours may form explosive mixture with air., May explode when heated.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist.

Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Refrigerate before opening. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis			
			parameters				
Carbon disulphide	75-15-0	TWA	1 ppm	USA. ACGIH Threshold Limit Values (TLV)			
	Remarks	Peripheral N	Peripheral Nervous System impairment				
		Substances	for which there is a	Biological Exposure Index or Indices			
		(see BEI® section)					
		Not classifial	ole as a human cai	cinogen			
		Danger of cu	itaneous absorptio	n			
		TWA	1.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)			
		Peripheral N	ervous System imp	pairment			
		Substances	for which there is a	Biological Exposure Index or Indices			
		(see BEI® se	(see BEI® section)				
		Not classifial	Not classifiable as a human carcinogen				
		Danger of cu	Itaneous absorptio	n			
		TWA	20.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2			
	1	Z37.3-1968	I				
		CEIL	30.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2			
		Z37.3-1968					
		Peak	100.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2			
		737 3-1968					
		TWA	1.000000 ppm	USA, NIOSH Recommended			
			3.000000 mg/m3	Exposure Limits			
		Potential for	dermal absorption				
	1	ST	10.000000 ppm	USA. NIOSH Recommended			
			30.000000	Exposure Limits			
			mg/m3	'			
		Potential for	dermal absorption				
		See Table Z	-2				
		TWA	20 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2			
	1	Z37.3-1968	1				
		CEIL	30 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2			
		Z37.3-1968					

	Peak	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
	Z37.3-1968		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
Carbon disulphide	75-15-0	2- Thiothiazolidi ne-4- carboxylix acid (TTCA)	0.5000 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As	s soon as po	ssible after exposure	e ceases)

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	Stench.
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -112 °C (-170 °F) - lit.
f)	Initial boiling point and boiling range	46 °C (115 °F) - lit.
g)	Flash point	-30 °C (-22 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 50 %(V) Lower explosion limit: 1.3 %(V)
k)	Vapour pressure	394.956 hPa (296.241 mmHg) at 20 °C (68 °F) 1,342.711 hPa (1,007.116 mmHg) at 55 °C (131 °F)
I)	Vapour density	2.63 - (Air = 1.0)
m)	Relative density	1.266 g/mL at 25 °C (77 °F)
n)	Water solubility	2.9 g/l at 20 °C (68 °F) - OECD Test Guideline 105
o)	Partition coefficient: n- octanol/water	log Pow: 2.7 at 25 °C (77 °F)
p)	Auto-ignition temperature	97 - 107 °C (207 - 225 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety information	
	Surface tension	71.9 mN/m at 19.5 °C (67.1 °F)
	Relative vapour density	2.63 - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks.

10.5 Incompatible materials Alkali metals, Zinc, Amines, Azides, Oxidizing agents Sigma-Aldrich - 180173

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - female - > 2,000 mg/kg (OECD Test Guideline 423)

LC50 Inhalation - Rat - male and female - 4 h - 10.35 mg/l (OECD Test Guideline 403)

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

- Mouse Result: Does not cause skin sensitisation. (OECD Test Guideline 429)

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Ames test Salmonella typhimurium Result: negative

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Suspected human reproductive toxicant

May cause reproductive disorders.

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: FF6650000

RIECS. FF0030000

May cause convulsions.

Liver - Irregularities - Based on Human Evidence Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Poecilia reticulata (guppy) - 4 mg/l - 96 h (OECD Test Guideline 203)
Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 2.1 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	Growth inhibition EC50 - Chlorella pyrenoidosa - 21 mg/l - 96 h (OECD Test Guideline 201)

12.2 Persistence and degradability

Biodegradability aerobic - Exposure time 28 d Result: > 80 % - Readily biodegradable (OECD Test Guideline 301D)

12.3 Bioaccumulative potential

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Packing group: I

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1131 Class: 3 (6.1) Proper shipping name: Carbon disulfide Reportable Quantity (RQ): 100 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 1131 Class: 3 (6.1) Proper shipping name: CARBON DISULPHIDE Packing group: I

EMS-No: F-E, S-D

IATA

UN number: 1131 Class: 3 (6.1) Proper shipping name: Carbon disulphide IATA Passenger: Not permitted for transport IATA Cargo: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components		
The following components are subject to reporting levels establish	ed by SARA Title III, CAS-No.	Section 302: Revision Date
Carbon disulphide	75-15-0	2007-07-01
SARA 313 Components The following components are subject to reporting levels establish	ned by SARA Title III, CAS-No.	Section 313: Revision Date
Carbon disulphide	75-15-0	2007-07-01
SARA 311/312 Hazards Fire Hazard, Acute Health Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
Carbon disulphide	CAS-No. 75-15-0	Revision Date 2007-07-01
Pennsylvania Right To Know Components		
Carbon disulphide	CAS-No. 75-15-0	Revision Date 2007-07-01
New Jersey Right To Know Components		
Carbon disulphide	CAS-No. 75-15-0	Revision Date 2007-07-01
California Prop. 65 Components WARNING: This product contains a chemical known to the State of California to cause birth defects or other reproductive harm. Carbon disulphide	CAS-No. 75-15-0	Revision Date 2008-06-17

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity		
Aquatic Acute	Acute aquatic toxicity		
Eye Irrit.	Eye irritation		
Flam. Liq.	Flammable liquids		
H225	Highly flammable liquid and vapour.		
H315	Causes skin irritation.		
H319	Causes serious eye irritation.		
H332	Harmful if inhaled.		
H361	Suspected of damaging fertility or the unborn child.		
H372	Causes damage to organs through prolonged or repeated exposure if inhaled.		
H401	Toxic to aquatic life.		
Repr.	Reproductive toxicity		
HMIS Rating			
Health hazard:	2		
Chronic Health Haza	ird: *		
Flammability:	3		
Physical Hazard	0		
NFPA Rating			
Health hazard:	2		
Fire Hazard:	3		
Reactivity Hazard:	0		
H319 H332 H361 H372 H401 Repr. HMIS Rating Health hazard: Chronic Health Haza Flammability: Physical Hazard NFPA Rating Health hazard: Fire Hazard: Reactivity Hazard:	Causes serious eye irritation. Harmful if inhaled. Suspected of damaging fertility or the unborn child. Causes damage to organs through prolonged or repeated exposure if inha Toxic to aquatic life. Reproductive toxicity 2 ard: * 3 0 2 3 0		

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.6

Revision Date: 12/10/2015

Print Date: 02/09/2016



Safety Data Sheet Revision Date: 05/11/15 www.restek.com

1. IDENTIFICATION

Catalog Number / Product Name: Company: Address:

Phone#: Fax#: Emergency#:

Email: Revision Number: Intended use: **32207, 32207-5XX, & 32307 / alpha-Chlordane Standard** Restek Corporation 110 Benner Circle Bellefonte, Pa. 16823 814-353-1300 814-353-1309 1-800-424-9300 (CHEMTREC) +1 703-741-5970 (Outside the US) sds@restek.com 6 For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:



GHS Classification:	Specific Target Organ Systemic Toxicity (STOT) - Single Exposure Category 1 Flammable Liquid Category 2 Acute Toxicity - Inhalation Dust / Mist Category 3 Acute Toxicity - Inhalation Vapour Category 3 Acute Toxicity - Inhalation Gas Category 3 Acute Toxicity - Dermal Category 3 Acute Toxicity - Oral Category 3
GHS Signal Word:	Danger
GHS Hazard:	Highly flammable liquid and vapour. Toxic if swallowed, in contact with skin or if inhaled. Toxic if inhaled. Causes damage to organs.
GHS Precautions:	
Safety Precautions:	Keep away from heat/sparks/open flames/hot surfaces. – No smoking. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilation and lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Do not breathe dust/fume/gas/mist/vapours/spray. Wash hands and skin thoroughly after handling. Do no eat, drink or smoke when using this product. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection.
First Aid Measures:	 IF SWALLOWED: Immediately call a POISON CENTER/doctor/ IF ON SKIN: Wash with plenty of soap and water. IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. IF exposed: Call a POISON CENTER or doctor/physician. Call a POISON CENTER or doctor/physician if you feel unwell. Specific treatment see section 4.

	Specific measures see section 4. Rinse mouth. Remove/Take off immediately all contaminated clothing. Wash contaminated clothing before reuse. In case of fire: Use extinguishing media in section 5 for extinction.
Storage:	Store in a well-ventilated place. Keep container tightly closed. Store in a well-ventilated place. Keep cool. Store locked up.
Disposal:	Dispose of contents/container according to section 13 of the SDS.
Single Exposure Target Organs:	No data available.
Repeated Exposure Target Organs:	No data available.

3. COMPOSITION / INFORMATION ON INGREDIENT

Chemical Name	CAS #	EINEC #	% Composition
methanol	67-56-1	200-659-6	99.900000
cis-chlordane	5103-71-9		0.100000

4. FIRST-AID MEASURES

Inhalation:	Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately
Eyes:	Flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention.
Skin Contact:	Wash with soap and water. Remove contaminated clothing and launder. Get medical attention if irritation develops or persists.
Ingestion:	Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS.

5. FIRE- FIGHTING MEASURES

Extinguishing Media:	Use alcohol resistant foam, carbon dioxide, or dry chemical extinguishing agents. Water may be ineffective but water spray can be used extinguish a fire if swept across the base of the flames. Water can absorb heat and keep exposed material from being damaged by fire.
Fire and/or Explosion Hazards:	Vapors may be ignited by sparks, flames or other sources of ignition if material is above the flash point giving rise to a fire (Class B). Vapors are heavier than air and may travel to a source of ignition and flash back.
Fire Fighting Methods and Protection:	Do not enter fire area without proper protection including self-contained breathing apparatus and full protective equipment. Fight fire from a safe distance and a protected location due to the potential of hazardous vapors and decomposition products. Flammable component(s) of this material may be lighter than water and burn while floating on the surface.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment:	Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.
Methods for Clean-up:	Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions: Top bre spa Storage Technical Measures and Conditions: Sto ince

Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area. Use spark-proof tools and explosion-proof equipment Store in a cool dry ventilated location. Isolate from incompatible materials and conditions. Keep container(s) closed. Keep away from sources of ignition

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:					
Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
methanol	67-56-1	6000 ppm IDLH	250 ppm STEL	200 ppm TWA	200 ppm TWA; 260 ma/m3 TWA
cis-chlordane	5103-71-9	ND		No TLV	No data available.
Personal Protection	n:				
Engineering Measure	ures:		Local exhaust v vapors from ha	entilation is recommending or thermal proc	anded when generating excessive levels of cessing.
Respiratory Protec	tion:		Respiratory pro product. Genera Use a respirato eliminate symp experiencing sy provide respirat	tection may be requir al or local exhaust ve r if general room vent toms.If an exposure li ymptoms of inhalation rory protection.	ed to avoid overexposure when handling this ntilation is the preferred means of protection. illation is not available or sufficient to mit is exceeded or if an operator is overexposure as explained in Section 3,
Eye Protection:			Wear chemicall product. Do not	y resistant safety glas wear contact lenses.	sses with side shields when handling this
Skin Protection:			Wear protective regular intervals exposed areas leaving work	e gloves. Inspect glov s. Clean protective ec with mild soap and w	es for chemical break-through and replace at juipment regularly. Wash hands and other ater before eating, drinking, and when

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color:	No data available.
Odor:	Mild
Physical State:	No data available.
pH:	No data available
Vapor Density:	1.1 (air = 1)
Melting Point:	-98 °C
Flash Point:	52
Flammability:	Highly Flammable
Upper Flammable/Explosive Limit, % in air:	36.0
Lower Flammable/Explosive Limit, % in air:	6.0
Autoignition Temperature:	464 deg C
Decomposition Temperature:	No data available.
Specific Gravity:	0.791 - 0.792 g/cm3 at 20 °C
Evaporation Rate:	No data available.
Odor Threshold:	No data available.
Solubility:	Moderate; 50-99%
Partition Coefficient: n-octanol in water:	No data available.
VOC % by weight:	99.90
Molecular Weight:	32.04
10. STABILITY AND REACTIVITY	
Stability:	Stable under normal conditions.
Conditions to Avoid:	No data available.

Materials to Avoid / Chemical Incompatiability:
Hazardous Decomposition Products:

Stable under normal conditions. No data available. Strong oxidizing agents Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation, Skin Contact, Eye Contact, Ingestion
Target Organs Potentially Affected By Exposure:	Eyes, Central nervous system stimulation, Skin, GI
	Tract, Respiratory Tract
Chemical Interactions That Change Toxicity:	None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation:	Can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.
Inhalation Toxicity:	Harmful! Can cause systemic damage (see "Target Organs)Methanol can cause central nervous system depression and overexposure can cause damage to the optic nerve resulting in visual impairment or blindness.
Skin Contact:	Can cause moderate skin irritation, defatting, and dermatitis. Not likely to cause permanent damage.
Eye Contact:	Can cause moderate irritation, tearing and reddening, but not likely to permanently injure eye tissue.
Ingestion Irritation:	Irritating to mouth, throat, and stomach. Can cause abdominal discomfort, nausea, vomiting and diarrhea. Highly toxic and may be fatal if swallowed.
Ingestion Toxicity:	Toxic if swallowed. May cause target organ failure and/or death.May be fatal if swallowed.

Long-Term (Chronic) Health Effe	ects:	
Carcinogenicity:		No data.
Reproductive and Developmen	tal Toxicity:	Contains a known human reproductive and/or
		developmental hazard.
Inhalation:		Upon prolonged and/or repeated exposure, can cause
		moderate respiratory irritation, dizziness, weakness, fatigue,
		"Target Organs)
Skin Contact:		Upon prolonged or repeated contact, can cause
		moderate skin irritation, defatting, and dermatitis. Not
		likely to cause permanent damage.
Ingestion:		Toxic if swallowed. May cause target organ failure
		and/or death.
Component Toxicological Data:		
NIOSH:		1 DE0/1 CE0
Methanol	67-56-1	Oral LD50 Rat 5628 mg/kg
		(Source: NLM_CIP); Inhalation
		LC50 Rat 83.2 mg/L 4 h (Source:
		IUCLID)
Component Carcinogenic Data:		
OSHA: Chemical Name	CAS No.	
No data available		
Chemical Name	CAS No.	
No data available.		
NIOSH:		
Chemical Name No data available	CAS NO.	
No data avaliable.		
NTP:		
Chemical Name	CAS No.	
No data available.		
IARC:		
Chemical Name	CAS No.	Group No.
No data. No data		Group 1 Group 24
cis-Chlordane	5103-71-9	Group 2B

12. ECOLOGICAL INFORMATION

Overview:

Mobility: Persistence:

Moderate ecological hazard. This product may be dangerous to plants and/or wildlife. No data No data

No data Biodegrades slowly. No data available.

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Disposal Methods:	Spent or discarded material is a hazardous waste. Dispose of by incineration following Federal, State, Local,
	or Provincial regulations.
Waste Disposal of Packaging:	Comply with all Local, State, Federal, and Provincial
	Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:	
DOT Proper Shipping Name:	Methanol
UN Number:	UN1230
Hazard Class:	3
Packing Group:	II
International: IATA Proper Shipping Name: UN Number: Hazard Class: Packing Group:	Methanol UN1230 3 (6.1) II

Marine Pollutant: No

No data available.	Chemical Name	CAS#	Marine Pollutant	Severe Marine Pollutant
	No data available.			

15. REGULATORY INFORMATION

United States:					
Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
methanol	67-56-1	Х	Х	-	Х
cis-chlordane	5103-71-9	Х	-	-	-

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Methanol	67-56-1	Prop 65 Devolop Tox

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
methanol	67-56-1	Х	Х	Х	Х
cis-chlordane	5103-71-9	-	-	-	-

16. OTHER INFORMATION

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accuracy. It is provided for your guidance only. Because many factors may affect
processing or application/use, Restek Corporation recommends you perform an
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fitness for a particular purpose, are made regarding prodcuts described, data or
information set forth. In no case shall the descriptions, information, or data provided
be considered a part of our terms and conditions of sale. Further, the descriptions,
data and information furnished hereunder are given gratis. No obligation or liability
for the description, data and information given are assumed. All such being given
and accepted at your risk.

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Montreal	St-Laurent	Tel : 514-956-7503	Fax : 514-956-7504
Ottawa	Nepean	Tel : 613-226-4228	Fax : 613-226-4229
Quebec	Quebec	Tel : 418-834-7447	Fax : 418-834-3774
	CHLOROBENZENE- MAT	ERIAL SAFETY	DATA SHEET

TABLE OF CONTENTS:

- 1. <u>Chemical Product and Company Identification</u>
- 2. <u>Composition, Information on Ingredients</u>
- 3. <u>Hazards Identification</u>
- 4. First Aid Measures
- 5. <u>Fire Fighting Measures</u>
- 6. <u>Accidental Release Measures</u>
- 7. Handling and Storage
- 8. Exposure Controls, Personal Protection
- 9. Physical and Chemical Properties
- 10. Stability and Reactivity
- 11. Toxicological Information
- 12. Ecological Information
- 13. Disposal Considerations
- 14. Transport Information
- 15. <u>Regulatory Information</u>
- 16. Other Information

24 Hour EMERGENCY CONTACT

U.S- CHEMTREC 1-800-424-9300

CANADA- CANUTEC 613-996-6666

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION of Contents

Up to Table

Matheson Tri-Gas, Inc.

The telephone numbers listed below are emergency numbers, please contact your <u>local</u> <u>branch</u> for routine inquiries.

USA

CANADA

959 Route 46 East Parsippany, New Jersey 07054-0624 USA Phone: 973-257-1100 530 Watson Street Whitby, Ontario L1N 5R9 Canada Phone: 905-668-3570

SUBSTANCE: CHLOROBENZENE

SYMBOL: C₆H₅Cl

TRADE NAMES/SYNONYMS:

PHENYL CHLORIDE; MONOCHLOROBENZENE; CP 27; I.P. CARRIER T 40; MCB; TETROSIR SP; U037; STCC 4909153; UN 1134; MONOCHLOROBENZOL; BENZENE CHLORIDE; B-224; B-255; BBENZENE, CHLORO; MAT04730; RTECS CZ0175000

CHEMICAL FAMILY: halogenated, aromatic

CREATION DATE: Jan 24 1989 REVISION DATE: Mar 16 1999

2. COMPOSITION, INFORMATION ON INGREDIENTS	Up to Table of
Contents	

COMPONENT: CHLOROBENZENE

CAS NUMBER: 108-90-7

EC NUMBER (EINECS): 203-628-5

EC INDEX NUMBER: 602-033-00-1

PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

Up to Table of Contents

NFPA RATINGS (SCALE 0-4): HEALTH=3 FIRE=3 REACTIVITY=0

WHMIS CLASSIFICATION: BD2

EC CLASSIFICATION (ASSIGNED): Flammable

Xn Harmful N Dangerous for the Environment

R 10-20-51/53

EC Classification may be inconsistent with independently-researched data.



EMERGENCY OVERVIEW: Color: colorless



Physical Form: liquid

Odor: almond odor

Major Health Hazards: harmful if inhaled, respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:

INHALATION:

Short Term Exposure: irritation, headache, drowsiness, symptoms of drunkenness, bluish skin color, coma

Long Term Exposure: tingling sensation, liver damage

SKIN CONTACT:

Short Term Exposure: irritation, rash Long Term Exposure: burns

EYE CONTACT:

Short Term Exposure: irritation Long Term Exposure: same as effects reported in short term exposure

INGESTION:

Short Term Exposure: nausea, vomiting, stomach pain, headache, symptoms of drunkenness, bluish skin color, coma Long Term Exposure: liver damage

CARCINOGEN STATUS:

OSHA: N NTP: N IARC: N

4. FIRST AID MEASURES

Up to Table of Contents

INHALATION:

Remove from exposure immediately. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Get medical attention.

SKIN CONTACT:

Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT:

Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION:

If vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN:

For ingestion, consider gastric lavage. Consider oxygen.

5. FIRE FIGHTING MEASURES

Up to Table of Contents

FIRE AND EXPLOSION HAZARDS:

Severe fire hazard. Moderate explosion hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back.

EXTINGUISHING MEDIA:

regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING:

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

FLASH POINT:

82 F (28 C) (CC)

LOWER FLAMMABLE LIMIT: 1.3%

UPPER FLAMMABLE LIMIT: 7.1%

AUTOIGNITION: 1099 F (593 C)

FLAMMABILITY CLASS (OSHA): IC

6. ACCIDENTAL RELEASE MEASURES

Up to Table of Contents

AIR RELEASE:

Reduce vapors with water spray.

SOIL RELEASE:

Trap spilled material at bottom in deep water pockets, excavated holding areas or within sand bag barriers. Dike for later disposal. Absorb with sand or other non-combustible material. Collect with absorbent into suitable container.

WATER RELEASE:

Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment.

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Reportable Quantity (RQ): Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

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Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Store with flammable liquids. Store outside or in a detached building. Keep separated from incompatible substances. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION Contents

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EXPOSURE LIMITS: CHLOROBENZENE:

75 ppm (350 mg/m3) OSHA TWA 10 ppm (46 mg/m3) ACGIH TWA

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

1000 ppm

Any supplied-air respirator.

Any powered, air-purifying respirator with organic vapor cartridge(s).

Any chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Escape -

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.

Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

Up to Table of Contents

PHYSICAL STATE: liquid

COLOR: colorless

ODOR: almond odor

MOLECULAR WEIGHT: 112.56

MOLECULAR FORMULA: C6-H5-CL

BOILING POINT: 270 F (132 C)

FREEZING POINT: -51 F (-46 C)

VAPOR PRESSURE: 8.8 mmHg @ 20 C

VAPOR DENSITY (air=1): 3.9

SPECIFIC GRAVITY (water=1): 1.107 @ 20/4 C

WATER SOLUBILITY: 0.1%

PH: Not available

VOLATILITY: Not available

ODOR THRESHOLD: 0.21 ppm

EVAPORATION RATE: 1 (butyl acetate=1)

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:

Soluble: alcohol, ether, chloroform, benzene, carbon disulfide, carbon tetrachloride

10. STABILITY AND REACTIVITY

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REACTIVITY:

Stable at normal temperatures and pressure.

CONDITIONS TO AVOID:

Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES:

combustible materials, oxidizing materials, metals

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: phosgene, halogenated compounds, oxides of carbon

POLYMERIZATION:

Will not polymerize.

11. TOXICOLOGICAL INFORMATION

Up to Table of Contents

CHLOROBENZENE:

TOXICITY DATA: 2965 ppm inhalation-rat LC50; 1110 mg/kg oral-rat LD50

CARCINOGEN STATUS: ACGIH: A3 -Animal Carcinogen

LOCAL EFFECTS: Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL: Moderately Toxic: inhalation, ingestion

TARGET ORGANS: central nervous system

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies

TUMORIGENIC DATA: Available.

MUTAGENIC DATA: Available.

REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: Alcohol may enhance the toxic effects.

12. ECOLOGICAL INFORMATION

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ECOTOXICITY DATA:

FISH TOXICITY: 10000 ug/L 96 hour(s) LC50 (Mortality) Sheepshead minnow (Cyprinodon variegatus)

INVERTEBRATE TOXICITY: 1720 ug/L 96 hour(s) LC50 (Mortality) Fleshy prawn (Penaeus chinensis)

ALGAL TOXICITY: 343000 ug/L 96 hour(s) EC50 (Photosynthesis) Diatom (Skeletonema costatum)

FATE AND TRANSPORT:

BIOCONCENTRATION:

4185 ug/L 48 day(s) BCF (Residue) Green algae (Oedogonium cardiacum) 1.01 ug/L

13. DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001. Hazardous Waste Number(s): D021. Dispose of in accordance with U.S. EPA 40 CFR 262 for

Hazardous Waste Number(s): D021. Dispose of in accordance with U.S. EPA 40 CFR 262 for concentrations at or above the Regulatory level. Regulatory level- 100.0 mg/L. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION Up to Table of Contents

U.S. DOT 49 CFR 172.101. SHIPPING NAME-UN NUMBER; HAZARD CLASS; PACKING GROUP; LABEL: Chlorobenzene-UN1134; 3; III; Flammable liquid

15. REGULATORY INFORMATION

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2

Up to Table of Contents

U.S. REGULATIONS: TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Y Monochlorobenzene CAS NUMBER: 108-90-7 SECTION 4

CERCLA SECTION 103 (40CFR302.4): Y Chlorobenzene: 100 LBS RQ

SARA SECTION 302 (40CFR355.30): N

SARA SECTION 304 (40CFR355.40): N

SARA SECTION 313 (40CFR372.65): Y Chlorobenzene

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21): ACUTE: Y CHRONIC: N FIRE: Y REACTIVE: N SUDDEN RELEASE: N

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS: California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 203-628-5

EC RISK AND SAFETY PHRASES:

R 10	Flammable.
R 20	Harmful by inhalation.
R 51/53	Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
S 2	Keep out of reach of children.
S 24/25	Avoid contact with skin and eyes.
S 61	Avoid release to the environment. Refer to special instructions/Safety data sheets.

16. OTHER INFORMATION Up to Table of Contents

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Health	2
Fire	0
Reactivity	0
Personal Protection	H

Material Safety Data Sheet **Chloroform MSDS**

Section 1: Chemical Product and Company Identification

Product Name: Chloroform Catalog Codes: SLC1888, SLC5044 CAS#: 67-66-3 RTECS: FS9100000 TSCA: TSCA 8(b) inventory: Chloroform Cl#: Not available. Synonym: Trichloromethane; Methane, trichlor-Chemical Name: Chloroform Chemical Formula: CHCI3

Contact Information:

Sciencelab.com. Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Chloroform	67-66-3	100

Toxicological Data on Ingredients: Chloroform: ORAL (LD50): Acute: 695 mg/kg [Rat]. 36 mg/kg [Mouse]. 820 mg/kg [Guinea pig]. DERMAL (LD50): Acute: >20000 mg/kg [Rabbit]. VAPOR (LC50): Acute: 47702 mg/m 4 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects: Hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Potential Chronic Health Effects: CARCINOGENIC EFFECTS: Classified + (Proven.) by NIOSH. Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, heart. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. WARM water MUST be used. Get medical attention.

Skin Contact: In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact: Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation: If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek medical attention.

Ingestion: Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: Not applicable.

Explosion Hazards in Presence of Various Substances: Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: May explode if it comes in contact with aluminum powder, lithium, perchlorate, pentoxide, bis(dimethylamino)dimethylstannane, potassium, potassium-sodium alloy, sodium (or sodium hydroxide or sodium methoxide), and methanol

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions: Do not ingest. Do not breathe gas/fumes/ vapor/spray. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as metals, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area. Sensitive to light. Store in light-resistant containers.

Section 8: Exposure Controls/Personal Protection

Engineering Controls: Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill: Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: TWA: 10 (ppm) [Australia] Inhalation TWA: 2 (ppm) from OSHA (PEL) [United States] Inhalation STEL: 9.78 (mg/m3) from NIOSH Inhalation STEL: 2 (ppm) from NIOSH Inhalation TWA: 9.78 (mg/m3) from OSHA (PEL) [United States] Inhalation TWA: 10 (ppm) from ACGIH (TLV) [United States] [1999] Inhalation TWA: 2 (ppm) [United Kingdom (UK)] Inhalation TWA: 9.9 (mg/m3) [United Kingdom (UK)] InhalationConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pleasant. Sweetish. Etheric. Non-irritating

Taste: Burning. Sweet.

Molecular Weight: 119.38 g/mole

Color: Colorless. Clear

pH (1% soln/water): Not available.

Boiling Point: 61°C (141.8°F)

Melting Point: -63.5°C (-82.3°F)

Critical Temperature: 263.33°C (506°F)

Specific Gravity: 1.484 (Water = 1)

Vapor Pressure: 21.1 kPa (@ 20°C)

Vapor Density: 4.36 (Air = 1)

Volatility: Not available.

Odor Threshold: 85 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 2

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Very slightly soluble in cold water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.
Instability Temperature: Not available.
Conditions of Instability: Incompatible materials, Light
Incompatibility with various substances: Reactive with metals, alkalis.
Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Light Sensitive. Incompatible with triisopropyl phosphine, acetone, disilane, fluorine, strong bases and reactive metals (aluminum, magnesium in powdered form), light.

Special Remarks on Corrosivity: It will attack some forms of plastics, rubber, and coatings.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation.

Toxicity to Animals: WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 36 mg/kg [Mouse]. Acute dermal toxicity (LD50): >20000 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 47702 mg/m 4 hours [Rat]. 3

Chronic Effects on Humans: CARCINOGENIC EFFECTS: Classified + (Proven.) by NIOSH. Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. Classified 2 (Some evidence.) by NTP. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, heart.

Other Toxic Effects on Humans: Hazardous in case of skin contact (irritant), of ingestion, of inhalation. Slightly hazardous in case of skin contact (permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: May affect genetic material (possible mutangen) and cause adverse reproductive effects(embryotoxicity and fetotoxicity) Suspected carcinogen (tumorigenic) and teratogen based on animal data. Human: passes the placental barrier, detected in maternal milk.

Special Remarks on other Toxic Effects on Humans: Acute Potential Health Effects: Skin: Causes skin irritation and may cause chemical burns. Eye: Causes eye irritation, burning pain and reversible injury to corneal epithelium. Inhalation: Causes irritation of the respiratory system (mucous membranes). May affect behavior/Nervous system (CNS depressant, fatigue, dizziness, nervousness, giddiness, euphoria, loss of coordination and judgement, weakness, hallucinations, muscle contraction/spasticity, general anesthetic, spastic paralysis, headache), anorexia (neurological and gastrointestinal symtoms resembling chronic alcoholism), and possibly coma and death. May affect the liver, kidneys and gastrointestinal tract (nausea, vomiting). Ingestion: Causes gastrointestinal tract irritation (nausea, vomiting). May affect the liver, urinary system (kidneys), respiration, behavior/nervous system (symptoms similar to inhalation), and heart. Chronic Potential Health Effects: Inhalation: Prolonged or repeated inhalation may affect the liver (hepatitis, jaundice, hepatocellular necrosis), metabolism (weight loss), respiration (fibrosis, pneumoconoisis), behavior/central nervous system (symptoms similar to acute inhalation), blood, musculoskeletal system, and kidneys. Ingestion: Prolonged or repeated ingestion may affect the liver, kidneys, metabolism (weight loss), endocrine system (spleen), blood (changes in cell count).

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 43.8 mg/l 96 hours [Trout].

BOD5 and COD: Not available.

Products of Biodegradation: Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are as toxic as the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Chloroform UNNA: UN1888 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations: California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Chloroform California prop. 65 (no significant risk level): Chloroform: 0.02 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Chloroform New York release reporting list: Chloroform Rhode Island RTK hazardous substances: Chloroform Pennsylvania RTK: Chloroform Massachusetts RTK: Chloroform New Jersey: Chloroform California Director's List of Hazardous Subtances (8 CCR 339): Chloroform Tennessee: Chloroform TSCA 8(b) inventory: Chloroform TSCA 8(d) H and S data reporting: Chloroform: effective: 6/1/87; sunset: 6/1/97 SARA 302/304/311/312 extremely hazardous substances: Chloroform SARA 313 toxic chemical notification and release reporting: Chloroform CERCLA: Hazardous substances.: Chloroform: 10 lbs. (4.536 kg)

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R20/22- Harmful by inhalation and if swallowed. R38- Irritating to skin. R40- Possible risks of irreversible effects. S36/37- Wear suitable protective clothing and gloves.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 0

Reactivity: 0

Personal Protection: h

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment: Gloves. Lab coat. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Version 6.3 Revision Date 04/18/2021 Print Date 07/31/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name	[:] Chloromethane
Product Number	: 295507
Brand	: Aldrich
Index-No.	: 602-001-00-7
CAS-No.	: 74-87-3

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	:	+1 314 771-5765

Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable gases (Category 1), H220 Gases under pressure (Liquefied gas), H280 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 2), H361 Specific target organ toxicity - repeated exposure, Inhalation (Category 2), Central nervous system, Liver, Urogenital tract, H373

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



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Signal word	Danger
Hazard statement(s) H220 H280 H351 H361 H373	Extremely flammable gas. Contains gas under pressure; may explode if heated. Suspected of causing cancer. Suspected of damaging fertility or the unborn child. May cause damage to organs (Central nervous system, Liver, Urogenital tract) through prolonged or repeated exposure if inhaled.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/ sparks/ open flames/ hot surfaces. No smoking.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.
P405	Store locked up.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS Contact with liquid or refrigerated gas can cause cold burns and frostbite.

SECTION 3: Composition/information on ingredients

3.1	Substances Synonyms	:	Methyl chloride		
	Formula	:	CH ₃ Cl		
	Molecular weight CAS-No. EC-No. Index-No.		50.49 g/mol 74-87-3 200-817-4 602-001-00-7		
	Component			Classification	Concentration
	methyl chloride				
				Flam. Gas 1; Press. Gas Liquefied gas; Carc. 2; Repr. 2; STOT RE 2; H220, H280, H351, H361fd, H373	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides Hydrogen chloride gas Combustible. Pay attention to flashback. Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Remove container from danger zone and cool with water. Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures Advice for non-emergency personnel: Do not breathe gas. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

- **6.2 Environmental precautions** Do not let product enter drains.
- **6.3 Methods and materials for containment and cleaning up** Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Stop flow of gas, move leaking cylinder to open air if without risk.
- **6.4 Reference to other sections** For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Keep away from combustible materials and sources of ignition.

Contents under pressure. Moisture sensitive. Storage class (TRGS 510): 2A: Gases

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
methyl chloride	74-87-3	TWA	50 ppm	USA. ACGIH Threshold Limit
				Values (TLV)
	Remarks	Not classifiable as a human carcinogen		
		Danger of o	cutaneous absor	ption
		STEL	100 ppm	USA. ACGIH Threshold Limit
				Values (TLV)
		Not classifi	able as a human	carcinogen

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Danger of cutaneous absorption			
Potential Occupational Carcinogen			
TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
Peak	300 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
STEL	100 ppm 205 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000	
TWA	50 ppm 105 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000	
STEL	100 ppm 210 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)	
С	300 ppm	California permissible exposure limits for chemical contaminants (Title 8, Article 107)	
PEL	50 ppm 105 mg/m3	California permissible exposure limits for chemical contaminants (Title 8, Article 107)	

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Body Protection

Flame retardant antistatic protective clothing.

Respiratory protection

required when vapours/mists are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance Form: compressed liquefied gas

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b)	Odor	No data available
c)	Odor Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -97 °C (-143 °F) - lit.
f)	Initial boiling point and boiling range	-24.2 °C -11.6 °F - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 17.4 %(V) Lower explosion limit: 7 %(V)
k)	Vapor pressure	5,060.9 hPa at 20.0 °C (68.0 °F)
I)	Vapor density	No data available
m)	Relative density	No data available
n)	Water solubility	5.32 g/l at 25 °C (77 °F) - soluble
o)	Partition coefficient: n-octanol/water	log Pow: 0.91
p)	Autoignition temperature	632.0 °C (1169.6 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety informatio	n
	Surface tension	0.02 mN/m at 20 °C (68 °F)

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

No data available

- **10.2 Chemical stability** The product is chemically stable under standard ambient conditions (room temperature) .
- **10.3 Possibility of hazardous reactions** No data available

10.4 Conditions to avoid

Heat, flames and sparks. no information available

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10.5 Incompatible materials Strong oxidizing agents, Iron

10.6 Hazardous decomposition products In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 1,800 mg/kg

LC50 Inhalation - Rat - male and female - 4 h - > 21,800 mg/m3 (OECD Test Guideline 403)

Dermal: No data available No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitization No data available

Germ cell mutagenicity

Species: Rat

Application Route: Inhalation

Result: negative Remarks: DNA damage DNA repair

Carcinogenicity

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available No data available

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Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure

Inhalation - May cause damage to organs through prolonged or repeated exposure. - Central nervous system, Liver, Urogenital tract

Aspiration hazard

No data available

11.2 Additional Information

RTECS: PA6300000

Dizziness, Drowsiness, Incoordination., Blurred vision, Headache, Nausea, Vomiting

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

Toxicity to fish	LC50 - Lepomis macrochirus (Bluegill) - 550 mg/l - 96 h
Toxicity to daphnia and other aquatic	semi-static test EC50 - Daphnia magna (Water flea) - 200 mg/l - 48 h
invertebrates	(OECD Test Guideline 202)

12.2 Persistence and degradability

aerobic - Exposure time 28 h

Result: 100 % - Readily biodegradable.

12.3 Bioaccumulative potential No data available

Biodegradability

12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. Pressurised gas bottle: dispose of only in empty

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condition! See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

UN number: 1063 Class: 2.1 Proper shipping name: Methyl chloride Reportable Quantity (RQ): 100 lbs Poison Inhalation Hazard: No

IMDG

UN number: 1063 Class: 2.1 Proper shipping name: METHYL CHLORIDE

ΙΑΤΑ

UN number: 1063 Class: 2.1 Proper shipping name: Methyl chloride IATA Passenger: Not permitted for transport

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
methyl chloride	74-87-3	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Sudden Release of Pressure Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

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EMS-No: F-D, S-U

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.3

Revision Date: 04/18/2021

Print Date: 07/31/2021

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Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Chromium MSDS

Section 1: Chemical Product and Company Identification

Product Name: Chromium

Catalog Codes: SLC4711, SLC3709

CAS#: 7440-47-3

RTECS: GB4200000

TSCA: TSCA 8(b) inventory: Chromium

Cl#: Not applicable.

Synonym: Chromium metal; Chrome; Chromium Metal Chips 2" and finer

Chemical Name: Chromium

Chemical Formula: Cr

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Chromium	7440-47-3	100

Toxicological Data on Ingredients: Chromium LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects:

Hazardous in case of skin contact (irritant), of eye contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, lungs, liver, upper respiratory tract. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention.

Skin Contact:

In case of contact, immediately flush skin with plenty of water. Cover the irritated skin with an emollient. Remove contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 580°C (1076°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Moderate fire hazard when it is in the form of a dust (powder) and burns rapidly when heated in flame. Chromium is attacked vigorously by fused potassium chlorate producing vivid incandescence. Pyrophoric chromium unites with nitric oxide with incandescence. Incandescent reaction with nitrogen oxide or sulfur dioxide.

Special Remarks on Explosion Hazards:

Powdered Chromium metal +fused ammonium nitrate may react violently or explosively. Powdered Chromium will explode spontaneously in air.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable protective clothing. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids, alkalis.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.5 (mg/m3) from ACGIH (TLV) [United States] TWA: 1 (mg/m3) from OSHA (PEL) [United States] TWA: 0.5 (mg/m3) from NIOSH [United States] TWA: 0.5 (mg/m3) [United Kingdom (UK)] TWA: 0.5 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Odorless.

Taste: Not available.

Molecular Weight: 52 g/mole

Color: Silver-white to Grey.

pH (1% soln/water): Not applicable.

Boiling Point: 2642°C (4787.6°F)

Melting Point: 1900°C (3452°F) +/- !0 deg. C

Critical Temperature: Not available.

Specific Gravity: 7.14 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility:

Insoluble in cold water, hot water. Soluble in acids (except Nitric), and strong alkalies.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, acids, alkalis.

Corrosivity: Not available.

Special Remarks on Reactivity:

Incompatible with molten Lithium at 180 deg. C, hydrogen peroxide, hydrochloric acid, sulfuric acid, most caustic alkalies and alkali carbonates, potassium chlorate, sulfur dioxide, nitrogen oxide, bromine pentafluoride. It may react violently or ignite with bromine pentafluoride. Chromium is rapidly attacked by fused sodium hydroxide + potassium nitrate. Potentially hazardous incompatibility with strong oxidizers.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. May cause damage to the following organs: kidneys, lungs, liver, upper respiratory tract.

Other Toxic Effects on Humans:

Hazardous in case of skin contact (irritant), of inhalation. Slightly hazardous in case of ingestion.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:

May cause cancer based on animal data. There is no evidence that exposure to trivalent chromium causes cancer in man.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: May cause skin irritation. Eyes: May cause mechanical eye irritation. Inhalation: May cause irritation of the respiratory tract and mucous membranes of the respiratory tract. Ingestion: May cause gastrointestinal tract irritation with nausea, vomiting, diarrhea. Chronic Potential Health Effects: Inhalation: The effects of chronic exposure include irritation, sneezing, reddness of the throat, bronchospasm, asthma, cough, polyps, chronic inflammation, emphysema, chronic bronchitis, pharyngitis, bronchopneumonia, pneumoconoisis. Effects on the nose from chronic chromium exposure include irritation, ulceration, and perforation of the nasal septum. Inflammation and ulceration of the larynx may also occur. Ingestion or Inhalation: Chronic exposure may cause liver and kidney damage.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Chromium Illinois toxic substances disclosure to employee act: Chromium Illinois chemical safety act: Chromium New York release reporting list: Chromium Rhode Island RTK hazardous substances: Chromium Pennsylvania RTK: Chromium Minnesota: Chromium Michigan critical material: Chromium Massachusetts RTK: Chromium Massachusetts spill list: Chromium New Jersey: Chromium New Jersey spill list: Chromium Louisiana spill reporting: Chromium California Director's List of Hazardous Substances: Chromium TSCA 8(b) inventory: Chromium SARA 313 toxic chemical notification and release reporting: Chromium CERCLA: Hazardous substances.: Chromium: 5000 lbs. (2268 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not controlled under WHMIS (Canada).

DSCL (EEC):

R40- Limited evidence of carcinogenic effect S36/37/39- Wear suitable protective clothing, gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 1

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 1

Reactivity: 0

Specific hazard:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:16 PM

Last Updated: 11/06/2008 12:00 PM

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SAFETY DATA SHEET

Based on Directive 2001/58/EC of the Commission of the European Communities

CHRYSENE

Identification of the substance/preparation and of the company/undertaking

1.1 Identification of the substance or preparation:

Synonyms:	none				
CĀS NO.	:	218-01-9	BCR number	:	BCR-269
EC index No.	:	601-048-00-0	NFPA code	:	N.D.
EINECS No.	:	205-923-4	Molecular weight	:	228.30
RTECS No.	:	GC0700000	Formula	:	C18H12

- 1.2 Use of the substance or the preparation: Certified reference material for laboratory use only
- 1.3 Company/undertaking identification: Institute for Reference Materials and Measurements Retieseweg B-2440 Geel Tel.: +32 14 57 12 11 Fax : +32 14 58 42 73
- 1.4 Telephone number for emergency: +32 70 245 245 Antigifcentrum p/a Militair Hospitaal Koningin Astrid, Bruynstraat, B-1120 Brussel

2. **Composition/information on ingredients**

Hazardous ingredients	CAS No. EINECS No.	Conc. in %	Hazard symbol	Risks (R-phrases)
chrysene	218-01-9	100	Τ;Ν	45-50/53 (1)
	205-923-4			

(1) For R-phrases in full: see heading 16

Hazards identification 3.

- May cause cancer
- Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

4. First aid measures

4.1 Eye contact:

Consult a doctor/medical service if irritation persists
 Rinse immediately with water

4.2 Skin contact:

- Consult a doctor/medical service if irritation persists
 Wash with water and soap
 Wipe off dry product from skin
 Remove clothing before washing

4.3 After inhalation:

- Consult a doctor/medical service if breathing problems develop
 Remove the victim into fresh air
 Unconscious: maintain adequate airway and respiration

4.4 After ingestion:

- Consult a doctor/medical service if you feel unwell
 Immediately give lots of water to drink
 Never give water to an unconscious person

Printing date Compiled by	:	07-2002 Brandweerinformatiece Technische Schoolstra	ntrum voor Gevaarlijke at 43 A, B-2440 Geel	e St	toffen vzw (BIG)	1 / 8
		🕿 +32 14 58 45 47	http://www.big.be		E-mail: info@big.be	
MSDS established Reference number Reason for revision	::	BIG\18207GB Directive 2001/58/EC	Revision date Revision number	:	22-03-2002 001	

- Do not induce vomiting

Fire-fighting measures

5.1 Suitable extinguishing media:

- Water spray
- Alcohol foam
- Polymer foamABC powderCarbon dioxide
- 5.2 Unsuitable extinguishing media: Solid water jet ineffective as extinguishing medium

5.3 Special exposure hazards:

- Not easily combustibleUpon combustion CO and CO2 are formed

5.4 Instructions:

- Take account of toxic firefighting water
- Use firefighting water moderately and contain it
- 5.5 Special protective equipment for firefighters:
 - Heat/fire exposure: compressed air/oxygen apparatus
 Dust cloud production: compressed air/oxygen apparatus

6. Accidental release measures

6.1 Personal protection/precautions: see heading 8.1/8.3/10.3

6.3 Methods for cleaning up:

- Stop dust cloud by covering with sand/earth Carefully collect the spill/leftovers Scoop solid spill into closing containers

- Spill must not return in its original container
- Take collected spill to manufacturer/competent authority
- Clean contaminated surfaces with an excess of water
- Wash clothing and equipment after handling

Handling and storage

7.1 Handling:

- Observe strict hygiene
- Avoid prolonged and repeated contact with skin
- Avoid raising dust
- Do not discharge the waste into the drain
- Remove contaminated clothing immediately

7.2 Storage:

- Keep container tightly closed. Store only in a limited quantity. Store in a dry area. Store in a dark area. - Keep away from: heat sources, ignition sources, oxidizing agents, acids

Storage temperature	3	: N.D.	°C
Quantity limits		: N.D.	kg
Materials for packa - suitable	ino data	available	

- to avoid : no data available

7.3 Specific uses:

See information supplied by the manufacturer

Exposure controls/Personal protection 8.

8.1 Exposure limit values:

TLV-TWA	:	not	listed
TLV-STEL	:	not	listed
TLV-Ceiling	:	not	listed
OES-LTEL OES-STEL MEL-LTEL MEL-STEL	::	not not not	listed listed listed listed
MAK	:	not	listed
TRK	:	not	listed
MAC-TGG 8 h	::	not	listed
MAC-TGG 15 min.		not	listed
MAC-Ceiling		not	listed
VME-8 h	:	not	listed
VLE-15 min.	:	not	listed
GWBB-8 h	:	not	listed
GWK-15 min.	:	not	listed
Momentary value	:	not	listed
EC	:	not	listed
EC-STEL		not	listed

Sampling methods:

-	Chrysene	(Polynuclear	aromatic	Hydrocarbons)	NIOSH	5515
-	Chrysene	-		-	OSHA	58
-	Chrysene	(Polynuclear	aromatic	Hydrocarbons)	NIOSH	5506

8.2 Exposure controls:

- 8.2.2 Environmental exposure controls: see heading 13

8.3 Personal protection:

- 8.3.1 respiratory protection: Dust production: dust mask with filter type P3 High dust production: compressed air/oxygen apparatus
- 8.3.2 hand protection: Gloves Suitable materials: No data available

- Breakthrough time: N.D.

8.3.3 eye protection:

- Safety glasses In case of dust production: protective goggles

8.3.4 skin protection:

Protective clothing
 In case of dust production: head/neck protection Suitable materials: No data available

Physical and chemical properties 9.

9.1 General information:

Appearance (a Odour Colour	t 20°C)	:	Crystalline Odourless White	solid	/	Flakes
COTOUL		•	WILLE			

9.2 Important health, safety and environmental information:

<pre>pH value Boiling point/boiling range Flashpoint Explosion limits Vapour pressure (at 20°C) Vapour pressure (at 50°C) Relative density (at 20°C) Water solubility Soluble in Relative vapour density Viscosity Partition coëfficient n-octanol/water Evaporation rate ratio to butyl acetate ratio to ether Other information:</pre>	: N.D. : 448 : N.D. : N.D. : N.D. : 1.27 : < 0.001 : N.D. : N.D. : N.D. : 5.61/5.73 : N.D. : N.D.	°C °C vol% (°C) hPa hPa g/100 ml Pa.s
Melting point/melting range	: 256	°C
Auto-ignition point	: N.D.	°C
Saturation concentration	: N.D.	g/m³

Melting point/melting range Auto-ignition point Saturation concentration

Stability and reactivity 10.

9.3

10.1 Conditions to avoid/reactivity:

Stable under normal conditions

10.2 Materials to avoid: - Keep away from: heat sources, ignition sources, oxidizing agents, acids

- 10.3 Hazardous decomposition products:
 Upon combustion CO and CO2 are formed
 Reacts violently with (strong) oxidizers
 Decomposes on exposure to (strong) acids

Toxicological information 11.

11.1 Acute toxicity:

LD50 LD50 LD50 LC50 LC50	oral rat dermal rat dermal rabbit inhalation rat inhalation rat	:	N.D. N.D. N.D. N.D. N.D.	mg/kg mg/kg mg/l/4 h ppm/4 h
LC20	innalation rat	:	N.D.	ppm/4 n

11.2 Chronic toxicity:

EC carc. cat. EC muta. cat. EC repr. cat.	: : :	2 3 not listed
Carcinogenicity (TLV) Carcinogenicity (MAC) Carcinogenicity (VME) Carcinogenicity (GWBB)	:	A3 K not listed not listed
Carcinogenicity (MAK) Mutagenicity (MAK) Teratogenicity (MAK)	: : :	2 not listed -
IARC classification	:	3
Routes of exposure:		ingestion, inhalation, eyes and skin Caution! Substance is absorbed through the skin

11.3 Routes of exposure:

11.4 Acute effects/symptoms:

AFTER SKIN CONTACT

Slight irritation

11.5 Chronic effects:

- Probably human carcinogenic
- No certainty about human mutagenic properties
- ON CONTINUOUS/REPEATED EXPOSURE/CONTACT: - No specific information available
- SIMILAR PRODUCTS CAUSE FOLLOWING SYMPTOMS:
- Feeling of weakness
- PhotoallergyCracking of the skin
- Skin rash/inflammation

- Skin cancer
 Lung tissue affection/degeneration
 Enlargement/affection of the liver
- Affection of the renal tissue

12. Ecological information

12.1 Ecotoxicity:

- LC50 (24 h) : LC50 (24 h) : 0.0007 mg/l (DAPHNIA MAGNA) >6.7 mg/l (RANA SP.)

12.2 Mobility:

- Volatile organic compounds (VOC): N.D.%
- Forming sediments in waterAdsorbs into the soilInsoluble in water

For other physicochemical properties see heading 9.

12.3 Persistence and degradability:

- biodegradation BOD_5	:		N.D.	% ThOD
- water	:	-	Not readil	y biodegradable in water

: T ½: > 77 - soil days

12.4 Bioaccumulative potential:

```
- log P<sub>ow</sub> : 5.61/5.73
- BCF : 4440 (LAMELLIBRANCHIATA)
```

- Highly bioaccumulative

12.5 Other adverse effects:

- WGK • 3 (Classification based on the R-phrases in compliance with Verwaltungsvorschrift wassergefährdender Stoffe (VwVwS) of 17 May 1999) : Not dangerous for the ozone layer (Council Regulation (EC) 3093/94)
- Effect on the ozone layer
- Greenhouse effect
- : no data available : no data available
- Effect on waste water purification

13. **Disposal considerations**

- 13.1 Provisions relating to waste: Waste material code (91/689/EEC, Council Decision 2001/118/EC, O.J. L47 of 16/2/2001): 16 05 06 (laboratory chemicals, consisting of or containing dangerous substances, including mixtures of laboratory) Waste material code (Flanders): 001, 045, 691 Waste code (Germany): 59302 Hazardous waste (91/689/EEC)

13.2 Disposal methods:

- Disposal methods.
 Dissolve or mix with a combustible solvent
 Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber
 Do not discharge into surface water (2000/60/EEC, Council

13.3 Packaging/Container:

Waste material code packaging (91/689/EEC, Council Decision
 2001/118/EC, O.J. L47 of 16/2/2001): 15 01 10 (packaging containing residues of or contaminated by dangerous substances)

7 / 8

14. Transport information



14.1	Classification of the substance in compliance UN number CLASS SUB RISKS PACKING PROPER SHIPPING NAME		with UN Recommendations 3077 9 - III UN 3077, Environmentally hazardous substance, solid, n.o.s. (chrysene)
14.2	ADR (transport by road) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.3	RID (transport by rail) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.4	ADNR (transport by inland waterways) CLASS PACKING DANGER LABEL TANKS DANGER LABEL PACKAGES	::	9 III 9 9
14.5	IMDG (maritime transport) CLASS SUB RISKS PACKING MFAG EMS MARINE POLLUTANT	:::::::::::::::::::::::::::::::::::::::	9 - III - P
14.6	ICAO (air transport) CLASS SUB RISKS PACKING PACKING INSTRUCTIONS PASSENGER AIRCRAFT PACKING INSTRUCTIONS CARGO AIRCRAFT	:::::::::::::::::::::::::::::::::::::::	9 - III
14.7	Special precautions in connection with transport	:	none
14.8	Limited quantities (LQ)	:	
	When substances and their packaging meet the ADR/RID/ADNR in chapter 3.4, only the followi complied with:		onditions established by g prescriptions shall be

complied with: each package shall display a diamond-shaped figure with the following inscription: - 'UN 3077' or, in the case of different goods with different identification numbers within a single package: - the letters 'LQ'

15. Regulatory information

Enumerated in substance list Annex I of directive 67/548/EEC et sequens



Toxic



Dangerous for the
environment

R45 : May cause cancer R50/53 : Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment

S53	:	Avoid exposure - obtain special instructions before use
S45	:	In case of accident or if you feel unwell, seek medical advice
		(show the label where possible)
S60	:	This material and/or its container must be disposed of as
		hazardous waste
S61	:	Avoid release to the environment. Refer to special
		instructions/safety data sheets.

16. Other information

The information provided on this MSDS is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or guality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

- N.A. = NOT APPLICABLE
 N.D. = NOT DETERMINED
- N.D. = NOT DETERMINED ★ = INTERNAL CLASSIFICATION

Full text of any R-phrases referred to under heading 2:

R45	:	May cause cancer
R50/53	:	Very toxic to aquatic organisms, may cause long-term adverse effects in the
		aquatic environment

Exposure limits:

TLV	:	Threshold Limit Value - ACGIH USA 2000
OES	:	Occupational Exposure Standards - United Kingdom 1999
MEL	:	Maximum Exposure Limits - United Kingdom 1999
MAK	:	Maximale Arbeitsplatzkonzentrationen - Germany 2001
TRK	:	Technische Richtkonzentrationen – Germany 2001
MAC	:	Maximale aanvaarde concentratie - The Netherlands 2002
VME	:	Valeurs limites de Moyenne d'Exposition - France 1999
VLE	:	Valeurs limites d'Exposition à court terme - France 1999
GWBB	:	Grenswaarde beroepsmatige blootstelling - Belgium 1998
GWK	:	Grenswaarde kortstondige blootstelling - Belgium 1998
EC	:	Indicative occupational exposure limit values - directive 2000/39/EC

Chronic toxicity:
 K : List of the carcinogenic substances and processes - The Netherlands 2002

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SAFETY DATA SHEET

Version 4.4 Revision Date 12/01/2015 Print Date 02/11/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	cis-Dichloroethylene	
	Product Number Brand Index-No.	::	48597 Supelco 602-026-00-3	
	CAS-No.	:	156-59-2	
1.2	Relevant identified uses of the substance or mixture and uses advised again			
	Identified uses	:	Laboratory chemicals, Synthesis of substances	

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Acute toxicity, Inhalation (Category 4), H332 Acute aquatic toxicity (Category 3), H402 Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s) H225 H332 H412	Highly flammable liquid and vapour. Harmful if inhaled. Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.

P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C2H2Cl2	
Molecular weight	: 96.94 g/m	lor
CAS-No.	: 156-59-2	
EC-No.	: 205-859-	7
Index-No.	: 602-026-0	00-3

Hazardous components

Component	Classification	Concentration
cis-Dichloroethylene		
	Flam. Liq. 2; Acute Tox. 4; Aquatic Acute 3; Aquatic Chronic 3; H225, H332, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature 2 - 8 °C

Handle and store under inert gas. Air and moisture sensitive. Light sensitive.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
cis-Dichloroethylene	156-59-2	TWA	200 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment Eye irritation		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: light yellow
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	-80.0 °C (-112.0 °F)
f)	Initial boiling point and boiling range	60.0 - 61.0 °C (140.0 - 141.8 °F)
g)	Flash point	6.0 °C (42.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	1.28 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available

p)	Auto-ignition	No data available
	temperature	

- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available

9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks. Extremes of temperature and direct sunlight.

- **10.5** Incompatible materials Oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LC50 Inhalation - Rat - 13700 ppm Remarks: Behavioral:Somnolence (general depressed activity). Liver:Fatty liver degeneration.

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: KV9420000

narcosis, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available
- **12.5** Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Harmful to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1150 Class: 3 Proper shipping name: 1,2-Dichloroethylene Packing group: II

Poison Inhalation Hazard: No

IMDG

UN number: 1150 Class: 3 Packing group: II Proper shipping name: 1,2-DICHLOROETHYLENE EMS-No: F-E, S-D

ΙΑΤΑ

UN number: 1150 Class: 3 Packing group: II Proper shipping name: 1,2-Dichloroethylene

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

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SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
cis-Dichloroethylene	156-59-2	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H332	Harmful if inhaled.
H402	Harmful to aquatic life.

2 3 0

HMIS Rating

NFPA Rating	
Physical Hazard	1
Flammability:	3
Chronic Health Hazard:	*
Health hazard:	1

0
Health hazard:
Fire Hazard:
Reactivity Hazard:

Further information

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Preparation Information Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.4

Revision Date: 12/01/2015

Print Date: 02/11/2016



Material Safety Data Sheet

Product Name: COBALT-BASED ALLOYS

ID: 1147

*** Section 1 - Chemical Product and Company Identification ***

Chemical Formula: Cobalt (Co), chromium (Cr) and other alloying elements Product Use: Cast aerospace parts Other Designations: 694, 98M2, CoCrNiMoFe, ECY 768, F75, FSX 414, G34, How 1, How 3, How 6, How 12, How 19, How 21, How 25 (L605), How 31 (X40), How 36, How F, How J, Mar-M 302, Mar-M 509, Mar-M 918, Merle 72, MP35N, S 816, PT1377, PT1508, WI 52, X 45 and other Cobalt-Based Alloys

Alcoa Inc. 201 Isabella Street Pittsburgh, PA 15212-5858 Phone: Health and Safety: 1-412-553-4649

Emergency Information: USA: Chemtrec: 1-800-424-9300 or 1-703-527-3887 Alcoa: 1-412-553-4001 **Website:** For a current MSDS, refer to Alcoa websites: www.alcoa.com or Internally at my.alcoa.com EHS Community

*** Section 2 - Hazards Identification ***

EMERGENCY OVERVIEW

Solid. Metallic appearance. Odorless. Non-combustible as supplied.

Explosion/fire hazards may be present when (See Sections 5, 7 and 10 for additional information):

* Molten metal is in contact with water/moisture.

* Heavily concentrated dust clouds are dispersed in the air.

Dust and fume from processing can cause irritation of eyes, skin and upper respiratory tract.

POTENTIAL HEALTH EFFECTS

The following statements summarize the health effects generally expected in cases of overexposures. User specific situations should be assessed by a qualified individual. Additional health information can be found in Section 11.

The health effects listed below are not likely to occur unless processing or recycling/combustion generate dusts or fumes.

Eyes <u>Dust or fume from processing</u>: Can cause irritation.

Skin <u>Dust or fume from processing</u>: Can cause irritation, sensitization and allergic contact dermatitis.

Inhalation <u>Health effects from mechanical processing (e.g., cutting, grinding)</u>: Can cause upper respiratory tract irritation. Chronic overexposures: Can cause asthma, respiratory sensitization, scarring of the lungs (pulmonary

fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males.

Additional health effects from elevated temperature processing (e.g., welding, melting): Acute overexposures: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever). Chronic overexposures: Can cause the accumulation of fluid in the lungs (pulmonary edema) and lung cancer.

Carcinogenicity and Reproductive Hazard

Product as shipped: Does not present any cancer or reproductive hazards.

Dust and fumes from mechanical processing: Can present a cancer hazard (nickel, cobalt). Can present a reproductive hazard for males (manganese).

<u>Dust and fumes from welding or elevated temperature processing</u>: Can present a cancer hazard (hexavalent chromium compounds, nickel compounds, welding fumes, cobalt compounds). Can present a reproductive hazard for males (manganese).

Medical Conditions Aggravated By Exposure to Product, Components or Compounds Formed During Processing Dust or fume from processing: Asthma, chronic lung disease, skin rashes and secondary Parkinson's disease.

Material Safety Data Sheet

Product Name: COBALT-BASED ALLOYS

*** Section 3 - Composition / Information on Ingredients **

Complete composition is provided below and may include some components classified as non-hazardous.			
CAS #	Component	Percent	
7440-48-4	Cobalt	35-65	
7440-47-3	Chromium	15-35	
7440-02-0	Nickel	0-35	
7440-33-7	Tungsten	0-25	
7439-89-6	Iron	0-20	
7439-98-7	Molybdenum	0-15	
7440-25-7	Tantalum	0-10	
7440-62-2	Vanadium	0-5	
7439-96-5	Manganese	0-5	
7429-90-5	Aluminum	0-5	
7440-03-1	Niobium	0-5	
7440-21-3	Silicon	0-5	
7440-44-0	Carbon	0-5	

Component Information

Additional compounds which may be formed during processing are listed in Section 8.

*** Section 4 - First Aid Measures ***

First Aid: Eyes

<u>Dust or fume from processing</u>: Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician.

First Aid: Skin

<u>Dust or fume from processing</u>: Wash skin with soap and water for at least 15 minutes. Consult a physician if irritation persists.

First Aid: Inhalation

<u>Dust or fume from processing:</u> Remove to fresh air. If unconscious or severely injured, check for clear airway, breathing and presence of pulse. Perform CPR if there is no pulse or respiration. Consult a physician.

*** Section 5 - Fire Fighting Measures ***

Flammable/Combustible Properties

This product does not present fire or explosion hazards as shipped. Dust and fines may be ignitable.

Fire/Explosion

May be a potential hazard under the following conditions:

* Molten metal in contact with water/moisture. Moisture entrapped by molten metal can be explosive. * Dust or fines dispersed in the air can be explosive. Heavily concentrated dusts in air can be explosive if subjected to a strong ignition source.

Extinguishing Media

Use a Class D agent, fluxing salts, graphite or dry sand on dust or fine fires. Otherwise, use fire fighting methods and materials that are appropriate for surrounding fire.

Unsuitable Extinguishing Media

DO <u>NOT</u> ŪSE:

* Water around molten metal.

These agents will react with the burning material.

Fire Fighting Equipment/Instructions

Fire fighters should wear NIOSH approved, positive pressure, self-contained breathing apparatus and full protective clothing when appropriate.

* * * Section 6 - Accidental Release Measures * * *

Small/Large Spill: Avoid generating dust. Recover using mechanical means. Collect scrap for recycling.

*** Section 7 - Handling and Storage ***

Handling/Storage

Avoid generating dust. Avoid contact with sharp edges or heated metal. Product should be kept dry. Do not eat, drink, apply cosmetics, or smoke when handling or using.

Requirements for Remelting of Scrap Material and/or Ingot

Molten metal and water can be an explosive combination. The risk is greatest when there is sufficient molten metal to entrap or seal off the water. Water and other forms of contamination on or contained in scrap or remelt ingot are known to have caused explosions in melting operations. While the products may have minimal surface roughness and internal voids, there remains the possibility of moisture contamination or entrapment. If confined, even a few drops of water can lead to violent explosions.

During melting operations, the following minimum guidelines should be observed:

* Inspect all materials prior to furnace charging and completely remove surface contamination such as water, ice, snow, deposits of grease and oil or other surface contamination resulting from weather exposure, shipment, or storage.

* Store materials in dry, heated areas with any cracks or cavities pointed downwards.

* Preheat and dry large or heavy items such as ingot adequately before charging into a furnace containing molten metal. This is typically done by use of a drying oven or homogenizing furnace. The drying cycle should bring the internal metal temperature of the coldest item of the batch to 400°F and then hold at that temperature for 6 hours.

*** Section 8 - Exposure Controls / Personal Protection ***

Engineering Controls

If dust or fumes are generated through processing: Use with adequate ventilation to meet the limits listed in Section 8, Exposure Guidelines.

Personal Protective Equipment

Respiratory Protection

If dust or fumes are generated through processing: Use NIOSH-approved respiratory protection as specified by an Industrial Hygienist or other qualified professional if concentrations exceed the limits listed in Section 8, Exposure Guidelines. Suggested respiratory protection: N95

Eye Protection Wear safety glasses/goggles to avoid eye injury.

Skin Protection Wear appropriate gloves to avoid any skin injury.

General

Personnel who handle and work with **molten metal** should utilize primary protective clothing like polycarbonate face shields, fire resistant tapper's jackets, neck shades (snoods), leggings, spats and similar equipment to prevent burn injuries. In addition to primary protection, secondary or day-to-day work clothing that is fire resistant and sheds metal splash is recommended for use with molten metal. Synthetic materials should never be worn even as secondary clothing (undergarments).

Exposure Guidelines

A: General Product Information

No Occupational Exposure Limit has been developed specifically for this product.

Alcoa recommends an Occupational Exposure Limit for **Cobalt** of 0.02 mg/m3 TWA.

Alcoa recommends an Occupational Exposure Limit for **Chromium (VI) Compounds [both soluble and insoluble forms]** of 0.25 ug/m3 TWA as chromium.

Alcoa recommends an Occupational Exposure Limit for Nickel Compounds of 0.1 mg/m3 TWA.

Alcoa recommends Occupational Exposure Limits for **Manganese** of 0.05 mg/m3 TWA (total particulate) and 0.02 mg/m3 TWA (respirable fraction).
Product Name: COBALT-BASED ALLOYS

B: Component Exposure Limits Cobalt (7440-48-4) ACGIH 0.02 mg/m3 TWA OSHA 0.1 mg/m3 TWA (dust and fume) Chromium (7440-47-3) ACGIH 0.5 mg/m3 TWA OSHA 1 mg/m3 TWA Nickel (7440-02-0) ACGIH 1.5 mg/m3 TWA (inhalable fraction) OSHA 1 mg/m3 TWA Tungsten (7440-33-7) ACGIH 5 mg/m3 TWA ACGIH 10 mg/m3 STEL Molybdenum (7439-98-7) ACGIH 10 mg/m3 TWA (inhalable fraction); 3 mg/m3 TWA (respirable fraction) OSHA 15 mg/m3 TWA (total dust) Tantalum (7440-25-7) ACGIH 5 mg/m3 TWA (dust) OSHA 5 mg/m3 TWA Vanadium (7440-62-2) OSHA 0.5 mg/m3 Ceiling (respirable dust, as V2O5); 0.1 mg/m3 Ceiling (fume, as V2O5) Manganese (7439-96-5) ACGIH 0.2 mg/m3 TWA OSHA 5 mg/m3 Ceiling (fume) Aluminum (7429-90-5) ACGIH 10 mg/m3 TWA (metal dust) OSHA 15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction) Silicon (7440-21-3) OSHA 15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction) C: Exposure Limits for Additional Compounds Which May Be Formed During Processing Chromium (II) compounds (Not Available) OSHA 0.5 mg/m3 TWA (as Cr) Chromium (III) Compounds (Not Available) ACGIH 0.5 mg/m3 TWA (as Cr) OSHA 0.5 mg/m3 TWA (as Cr) Chromium (VI) compounds- water soluble (Not Available) ACGIH 0.05 mg/m3 TWA (as Cr) Chromium (VI) compounds (certain water insoluble forms) (Not Available) ACGIH 0.01 mg/m3 TWA (as Cr) Chromium (VI) (18540-29-9) OSHA 2.5 µg/m3 Action Level; 5 µg/m3 TWA (Cancer hazard - See 29 CFR 1910.1026) Nickel insoluble compounds (Not Available) ACGIH 0.2 mg/m3 TWA (inhalable fraction, as Ni) OSHA 1 mg/m3 TWA (as Ni) Tungsten, insoluble compounds (Not Available) ACGIH 5 mg/m3 TWA (as W) ACGIH 10 mg/m3 STEL (as W) Iron oxide (1309-37-1) ACGIH 5 mg/m3 TWA (respirable fraction) OSHA 10 mg/m3 TWA

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Molybdenum insoluble compounds (Not Available)

ACGIH 10 mg/m3 TWA (inhalable fraction, as Mo); 3 mg/m3 TWA (respirable fraction, as Mo) OSHA 15 mg/m3 TWA (total dust)

OSHA 15 mg/m3 1 WA (total t

Tantalum oxide (1314-61-0)

ACGIH 5 mg/m3 TWA (dust, as Ta)

OSHA 5 mg/m3 TWA (dust)

Vanadium pentoxide (1314-62-1)

ACGIH 0.05 mg/m3 TWA (dust or fume, respirable fraction)

OSHA 0.5 mg/m3 Ceiling (respirable dust, as V2O5); 0.1 mg/m3 Ceiling (fume, as V2O5)

Manganese compounds, inorganic (Not Available)

ACGIH 0.2 mg/m3 TWA (as Mn)

OSHA 5 mg/m3 Ceiling (as Mn) (related to Manganese compounds)

Aluminum oxide (1344-28-1)

ACGIH 10 mg/m3 TWA (particulate matter containing no asbestos and <1% crystalline silica)

OSHA 15 mg/m3 TWA (total dust); 5 mg/m3 TWA (respirable fraction)

*** Section 9 - Physical & Chemical Properties ***

Physical State:SolidBoiling Point:Not determinedVapor Pressure:Not applicableSolubility in Water:Not solubleDensity:550 lb/ft3 (8.8 g/cm3)Odor:OdorlessOctanol-Water Coefficient:Not applicable

Appearance:Metallic appearanceMelting Point:2719°F (1493°C) CobaltVapor Density:Not applicableSpecific Gravity:See DensitypH Level:Not applicableOdor Threshold:Not applicable

*** Section 10 - Chemical Stability & Reactivity Information ***

Stability Stable under normal conditions of use, storage, and transportation. **Conditions to Avoid**

In powder form, can react with strong oxidizers such as concentrated nitric acid. Molten metal can react violently/explosively with water or moisture, particularly when the water is entrapped.

*** Section 11 - Toxicological Information ***

Health Effects Associated with Individual Ingredients

Cobalt Can cause irritation of eyes, skin and respiratory tract. <u>Skin contact:</u> Can cause allergic reactions. <u>Acute and chronic overexposures:</u> Can cause respiratory sensitization, asthma, scarring of the lungs (pulmonary fibrosis) and damage to the heart muscle (cardiomyopathy). **Cobalt and certain cobalt compounds** <u>IARC/NTP:</u> Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Chromium dust and mist Can cause irritation of eyes, skin and respiratory tract. **Chromium and trivalent chromium** <u>IARC/NTP:</u> Listed as "unclassifiable as to carcinogenicity in humans" by IARC (Group 3).

Nickel dust and fumes Can cause irritation of eyes, skin and respiratory tract. <u>Eye contact:</u> Can cause inflammation of the eyes and eyelids (conjunctivitis). <u>Skin contact:</u> Can cause sensitization and allergic contact dermatitis. <u>Chronic overexposures:</u> Can cause perforation of the nasal septum, inflammation of the nasal passages (sinusitis), respiratory sensitization, asthma and scarring of the lungs (pulmonary fibrosis). **Nickel alloys** <u>IARC/NTP:</u> Reviewed but not recommended for listing by the NTP. Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Tungsten dust Can cause irritation of eyes, skin and upper respiratory tract.

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Molybdenum dust and fumes Can cause irritation of mucous membranes, skin and respiratory tract. <u>Acute overexposures:</u> Can cause headache, backache and sore joints. <u>Chronic overexposures:</u> Can cause deformities of the joints, blood disorders, kidney damage, lung damage and liver damage.

Tantalum and tantalum oxide Can cause mechanical irritation of eyes, skin and upper respiratory tract. Generally of low toxicity.

Manganese dust or fumes <u>Chronic overexposures:</u> Can cause inflammation of the lung tissue, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males.

Aluminum dust, fines and fumes Low health risk by inhalation. Generally considered to be biologically inert.

Niobium dust and fumes <u>Acute overexposures:</u> Generally of low toxicity. <u>Chronic overexposures:</u> Can cause lung damage.

Silicon, inert dusts <u>Chronic overexposures:</u> Can cause chronic bronchitis and narrowing of the airways.

Health Effects Associated with Individual Compounds Formed During Processing

(The following could be expected if welded, remelted or otherwise processed at elevated temperatures.) Hexavalent chromium (Chrome VI) Can cause irritation of eyes, skin and respiratory tract. <u>Skin contact</u>: Can cause irritant dermatitis, allergic reactions and skin ulcers. <u>Chronic overexposures</u>: Can cause perforation of the nasal septum, respiratory sensitization, asthma, the accumulation of fluid in the lungs (pulmonary edema), lung damage, kidney damage, lung cancer, nasal cancer and cancer of the gastrointestinal tract. <u>IARC/NTP</u>: Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Nickel compounds Associated with lung cancer, cancer of the vocal cords and nasal cancer. <u>IARC/NTP:</u> Listed as "known to be a human carcinogen" by the NTP. Listed as carcinogenic to humans by IARC (Group 1)*.

Iron oxide <u>Chronic overexposures:</u> Can cause benign lung disease (siderosis). <u>Ingestion:</u> Can cause irritation of gastrointestinal tract, bleeding, changes in the pH of the body fluids (metabolic acidosis) and liver damage.

Molybdenum trioxide Can cause irritation of eyes, mucous membranes and upper respiratory tract. <u>Chronic overexposures:</u> Can cause reduction in the number of red blood cells (anemia), predisposition to gout, thyroid function changes, liver damage and lung damage. <u>Additional information:</u> Studies with experimental animals by inhalation have found lung cancer.

Vanadium pentoxide Can cause irritation of eyes, skin and respiratory tract. <u>Skin contact (prolonged or repeated)</u>: Can cause sensitization and dermatitis. <u>Acute overexposures</u>: Can cause inflammation of the eyes and eyelids (conjunctivitis), bronchitis and the accumulation of fluid in the lungs (pulmonary edema). Effects can be delayed for several days. <u>Chronic overexposures</u>: Can cause kidney damage, blindness, asthma and emphysema. <u>IARC/NTP</u>: Listed as possibly carcinogenic to humans by IARC (Group 2B)*.

Manganese oxide fumes Can cause irritation of eyes, skin and respiratory tract. <u>Acute overexposures:</u> Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever).

Alumina (aluminum oxide) Low health risk by inhalation. Generally considered to be biologically inert.

Silica, amorphous Acute overexposures: Can cause dryness of eyes, nose and upper respiratory tract.

Acute Toxicity of Ingredients/Formed Compounds

A: General Product Information No information available for product.

B: Component Analysis - LD50/LC50

Cobalt (7440-48-4) Inhalation LC50 Rat: >10 mg/L/1H; Oral LD50 Rat:6170 mg/kg

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Nickel (7440-02-0) Oral LD50 Rat: >9000 mg/kg Iron (7439-89-6) Oral LD50 Rat: 984 mg/kg Manganese (7439-96-5) Oral LD50 Rat: 9 g/kg Silicon (7440-21-3) Oral LD50 Rat: 3160 mg/kg Carbon (7440-44-0) Oral LD50 Rat: >10000 mg/kg

C: Formed Compound Toxicity - LD50s/LC50s

Iron oxide (1309-37-1) Oral LD50 Rat: >10000 mg/kg Tantalum oxide (1314-61-0) Oral LD50 Rat: 8 g/kg Vanadium pentoxide (1314-62-1) Inhalation LC50 Rat: 2.21 mg/L/4H; Oral LD50 Rat:10 mg/kg; Dermal LD50 Rat:>2500 mg/kg Aluminum oxide (1344-28-1) Oral LD50 Rat: >5000 mg/kg Silicon dioxide (amorphous) (69012-64-2) Oral LD50 Rat: >5000 mg/kg; Inhalation LC50 Rat:>2.2 mg/L/1H; Dermal LD50 Rabbit:>2000 mg/kg (related to Silica, amorphous)

Carcinogenicity of Ingredients

A: Ingredient Carcinogenicity - IARC/NTP

Component	CAS						NTP K	
		•	27	20	5	-	IX I	
Cobalt	7440-48-4	No	No	Yes	No	No	No	No
Chromium	7440-47-3	No	No	No	Yes	No	No	No
Nickel	7440-02-0	No	No	Yes	No	No	No	No

B: Ingredient Carcinogenicity - ACGIH

Cobalt (7440-48-4)

ACGIH A3 - Confirmed animal carcinogen with unknown relevance to humans

Chromium (7440-47-3)

ACGIH A4 - Not Classifiable as a Human Carcinogen

Nickel (7440-02-0)

ACGIH A5 - Not Suspected as a Human Carcinogen

C: Ingredient References

Cobalt (7440-48-4)

IARC Monograph 86 [2006] (without tungsten carbide), Monograph 52 [1991]

Chromium (7440-47-3)

IARC Monograph 49 [1990] (listed under Chromium and Chromium compounds),

Supplement 7 [1987]

Nickel (7440-02-0)

IARC Monograph 49 [1990], Supplement 7 [1987]

Carcinogenicity of Compounds Formed During Processing

A: Formed Compound Carcinogenicity - IARC/NTP

Component	CAS	IARC	IARC	IARC	IARC	IARC	NTP	NTP
-		1	2A	2B	3	4	κ	RA
Chromium (III) Compounds	Not Available	No	No	No	Yes	No	No	No
Chromium (VI) compounds	Not Available	Yes	No	No	No	No	Yes	No
(certain water insoluble forms)								
Nickel compounds	Not Available	Yes	No	No	No	No	Yes	No
Iron oxide	1309-37-1	No	No	No	Yes	No	No	No
Vanadium pentoxide	1314-62-1	No	No	Yes	No	No	No	No
Silicon dioxide (amorphous) (69012-64-2	No	No	No	Yes	No	No	No
related to Silica, amorphous)								

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Product Name: COBALT-BASED ALLOYS **B:** Formed Compound Carcinogenicity - ACGIH Chromium (III) Compounds (Not Available) ACGIH A4 - Not Classifiable as a Human Carcinogen Chromium (VI) compounds- water soluble (Not Available) ACGIH A1 - Confirmed Human Carcinogen Chromium (VI) compounds (certain water insoluble forms) (Not Available) ACGIH A1 - Confirmed Human Carcinogen Nickel insoluble compounds (Not Available) ACGIH A1 - Confirmed Human Carcinogen Iron oxide (1309-37-1) ACGIH A4 - Not Classifiable as a Human Carcinogen Vanadium pentoxide (1314-62-1) ACGIH A4 - Not Classifiable as a Human Carcinogen (dust and fume) Aluminum oxide (1344-28-1) ACGIH A4 - Not Classifiable as a Human Carcinogen **C: Formed Compound References** Chromium (III) Compounds (Not Available) IARC Monograph 49 [1990] (listed under Chromium and Chromium compounds), Supplement 7 [1987] Chromium (VI) compounds (certain water insoluble forms) (Not Available) IARC Monograph 49 [1990] (evaluated as a group) Chromium (VI) (18540-29-9) IARC Monograph 49 [1990] (evaluated as a group) Nickel compounds (Not Available) IARC Monograph 49 [1990] (evaluated as a group) Iron oxide (1309-37-1) IARC Supplement 7 [1987], Monograph 1 [1972] Vanadium pentoxide (1314-62-1) IARC Monograph 86 [2006] Silicon dioxide (amorphous) (69012-64-2) IARC Monograph 68 [1997], Supplement 7 [1987] (related to Silica, amorphous) **Descriptions of IARC and NTP Classifications**

IARC 1: <u>The agent is carcinogenic to humans.</u> There is sufficient evidence that a causal relationship existed between exposure to the agent and human cancer.

IARC 2A: <u>The agent is probably carcinogenic to humans.</u> Generally includes agents for which there is limited evidence of carcinogenicity in humans and sufficient evidence of carcinogenicity in experimental animals. **IARC 2B:** The agent is possibly carcinogenic to humans. Generally includes agents for which there is limited

evidence in humans and less than sufficient evidence in experimental animals.

IARC 3: <u>The agent is not classifiable as to its carcinogenicity to humans.</u> Generally includes agents for which there is inadequate evidence in humans and inadequate or limited evidence in experimental animals.

IARC 4: <u>The agent is probably not carcinogenic to humans.</u> Generally includes agents for which there is evidence suggesting lack of carcinogenicity in humans and in experimental animals.

NTP K: Known to be a human carcinogen.

NTP RA: Reasonably anticipated to be a human carcinogen.

*** Section 12 - Ecological Information ***

Ecotoxicity

A: General Product Information No information available for product.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Cobalt (7440-48-4) 96 Hr LC50 Brachydanio rerio: >100 mg/L [static]

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Nickel (7440-02-0)

96 Hr LC50 Oncorhynchus mykiss: 31.7 mg/L (adult); 96 Hr LC50 Pimephales promelas: 3.1 mg/L; 96 Hr LC50 Brachydanio rerio: >100 mg/L 72 Hr EC50 freshwater algae (4 species): 0.1 mg/L; 72 Hr EC50 Selenastrum capricornutum: 0.18 mg/L 96 Hr EC50 water flea: 510 μg/L **Iron (7439-89-6)** 96 Hr LC50 Morone saxatilis: 13.6 mg/L [static]

Environmental Fate No information available for product.

*** Section 13 - Disposal Considerations ***

Disposal Instructions Reuse or recycle material whenever possible.

US EPA Waste Number & Descriptions

A: General Product Information

If reuse or recycle is not possible, then characterize in accordance with applicable regulations (40 CFR 261 or state equivalent in the U.S.) prior to disposal. TCLP testing is recommended for chromium.

B: Component Waste Numbers

RCRA waste codes other than described under Section A may apply depending on use of product. Refer to 40 CFR 261 or state equivalent in the U.S.

*** Section 14 - Transportation Information ***

Special Transportation

	PSN #1	PSN #2	PSN #3	PSN #4	
Notes:	(1)				
UN NA Number:	-				
Proper Shipping Name:	Not regulated				
Hazard Class:	-				
Packing Group:	-				
RQ:	-				
Other - Tech Name:	-				
Other - Marine Pollutant:	-				

Notes:

(1) When "Not regulated," enter the proper freight classification, "MSDS Number," and "Product Name" on the shipping paperwork.

Canadian Controlled Products Regulation PIN: Not regulated

* * * Section 15 - Regulatory Information * * *

US Federal Regulations

A: General Product Information

In reference to Title VI of the Clean Air Act of 1990, this material does not contain nor was it manufactured using ozone-depleting chemicals.

B: Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Cobalt (7440-48-4)

SARA 313: 0.1 % de minimis concentration

Chromium (7440-47-3)

SARA 313: 1.0 % de minimis concentration

CERCLA: 5000 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 2270 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

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Nickel (7440-02-0)

SARA 313: 0.1 % de minimis concentration

CERCLA: 100 lb final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers); 45.4 kg final RQ (no reporting of releases of this hazardous substance is required if the diameter of the pieces of the solid metal released is larger than 100 micrometers)

Yes, if particulates/fumes generated during processing

Vanadium (7440-62-2)

SARA 313: 1.0 % de minimis concentration (except when contained in an alloy)

Manganese (7439-96-5)

SARA 313: 1.0 % de minimis concentration

Aluminum (7429-90-5)

SARA 313: 1.0 % de minimis concentration (dust or fume only)

SARA 311/312 Physical and Health Hazard Categories:

Immediate (acute) Health Hazard:

Delayed (chronic) Health Hazard: Yes, if particulates/fumes generated during processing Fire Hazard: No

Sudden Release of Pressure: No

Reactive: No

State Regulations

A: General Product Information PENNSYLVANIA "Special Hazardous Substance": Chromium, Nickel

Chemical(s) known to the State of California to cause cancer: Chromium (hexavalent compounds), Cobalt metal powder, Nickel (metallic) and nickel compounds

B: Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS #	CA	FL	MA	MN	NJ	PA
Cobalt	7440-48-4	Yes	No	Yes	Yes	Yes	Yes
Chromium	7440-47-3	Yes	No	Yes	Yes	Yes	Yes
Nickel	7440-02-0	Yes	No	Yes	Yes	Yes	Yes
Tungsten	7440-33-7	Yes	No	Yes	Yes	Yes	Yes
Iron	7439-89-6	Yes	No	No	No	No	No
Molybdenum	7439-98-7	Yes	No	Yes	Yes	Yes	Yes
Tantalum	7440-25-7	Yes	No	Yes	Yes	Yes	Yes
Vanadium	7440-62-2	Yes	No	Yes	No	Yes	Yes
Manganese	7439-96-5	Yes	No	Yes	Yes	Yes	Yes
Aluminum	7429-90-5	Yes	No	Yes	Yes	Yes	Yes
Silicon	7440-21-3	No	No	Yes	Yes	Yes	Yes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Other Regulations

A: General Product Information Material meets the criteria for inclusion in WHMIS Class D2A.

B: Component Analysis - WHMIS IDL

The following components are identified under the Canadian Hazardous Products Act Ingredient Disclosure List:

Component	CAS #	Minimum Concentration
Cobalt	7440-48-4	0.1 %
Chromium	7440-47-3	0.1 %
Nickel	7440-02-0	0.1 %
Tungsten	7440-33-7	1 %
Molybdenum	7439-98-7	1 %
Tantalum	7440-25-7	1 %
Vanadium	7440-62-2	1 %
Manganese	7439-96-5	1 %
Aluminum	7429-90-5	1 %

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C: Component Analysis - Inventory

Component	CAS #	TSCA	DSL	EINECS	AUST.	ΜΙΤΙ
Cobalt	7440-48-4	Yes	Yes	Yes	Yes	No
Chromium	7440-47-3	Yes	Yes	Yes	Yes	No
Nickel	7440-02-0	Yes	Yes	Yes	Yes	No
Tungsten	7440-33-7	Yes	Yes	Yes	Yes	No
Iron	7439-89-6	Yes	Yes	Yes	Yes	No
Molybdenum	7439-98-7	Yes	Yes	Yes	Yes	No
Tantalum	7440-25-7	Yes	Yes	Yes	Yes	No
Vanadium	7440-62-2	Yes	Yes	Yes	Yes	No
Manganese	7439-96-5	Yes	Yes	Yes	Yes	No
Aluminum	7429-90-5	Yes	Yes	Yes	Yes	No
Niobium	7440-03-1	Yes	Yes	Yes	Yes	No
Silicon	7440-21-3	Yes	Yes	Yes	Yes	No
Carbon	7440-44-0	Yes	Yes	Yes	Yes	No

Inventory information

MITI Inventory: Pure metals are not specifically listed by CAS or MITI number on the MITI Inventory. However, the class of compounds for each of these metals is listed.

*** Section 16 - Other Information ***

MSDS History

Original: June 18, 2001 Supersedes: October 11, 2004 Revised: April 22, 2008

MSDS Status

04/22/2008: Reviewed on a periodic basis in accordance with Alcoa policy. Changes in Sections 1, 2, 3, 4, 5, 8, 11, 12, 13, 14 & 15.

10/11/2004: Combined with Alcoa MSDS #'s 1148 and 1149. Changes in Sections 1, 2, 3, 8 and 15. Covers some products formerly on Howmet MSDSs 201, 202, 203, 204, 205, 206 and 504.

06/18/2001: New MSDS; covers some products formerly on Howmet MSDS 201.

Prepared By

Hazardous Materials Control Committee

Preparer: Stephanie Williams, 412-553-1479/Jon N. Peace, 412-553-2293

MSDS System Number

159242

Other Information

* <u>Guide to Occupational Exposure Values-2007</u>, Compiled by the American Conference of Governmental Industrial Hygienists (ACGIH).

* <u>Documentation of the Threshold Limit Values and Biological Exposure Indices</u>, Sixth Edition, 1991, Compiled by the American Conference of Governmental Industrial Hygienists, Inc. (ACGIH).

* NIOSH Pocket Guide to Chemical Hazards, U.S. Department of Health and Human Services, February 2004.

* Patty's Industrial Hygiene and Toxicology: Volume II: Toxicology, 4th ed., 1994, Patty, F. A.; edited by Clayton, G. D. and Clayton, F. E.: New York: John Wiley & Sons, Inc.

* expub, www.expub.com, Expert Publishing, LLC.

Product Name: COBALT-BASED ALLOYS

Key-Legend:	
ACGIH	American Conference of Governmental Industrial Hygienists
AICS	Australian Inventory of Chemical Substances
CAS	Chemical Abstract Service
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CPR	Cardio-pulmonary Resuscitation
DOT	Department of Transportation
DSL	Domestic Substances List (Canada)
FC	Effective Concentration
FD	Effective Dose
FINECS	European Inventory of Existing Commercial Chemical Substances
FPA	Environmental Protection Act
IARC	International Agency for Research on Cancer
	Lethal concentration (50 percent kill)
	Lowest published lethal concentration
	Lethal dose (50 percent kill)
	Lewest published lethal dese
	Lowest published lethal dose
	Lower Finimable Limit
	National Fire Distantion Accession
	National Fire Protection Association
NIUSH	National Institute for Occupational Safety and Health
NORM	Naturally Occurring Radioactive Materials
	National Toxicology Program
OEL	Occupational Exposure Limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible Exposure Limit
PIN	Product Identification Number
PSN	Proper Shipping Name
RCRA	Resource Conservation and Recovery Act
SARA	Superfund Amendments and Reauthorization Act
STEL	Short Term Exposure Limit
TCLP	Toxic Chemicals Leachate Program
TDG	Transportation of Dangerous Goods
TLV	Threshold Limit Value
TSCA	Toxic Substance Control Act
TWA	Time Weighted Average
UFL	Upper Flammable Limit
WHMIS	Workplace Hazardous Materials Information System
atm	atmosphere
cm	centimeter
g, gm	gram
in	inch
kg	kilogram
lb	pound
m	meter
mg	milligram
ml. ML	milliliter
mm	millimeter
mppcf	million particles per cubic foot
n.o.s.	not otherwise specified
dad	parts per billion
nnm	narts per million
nsia	nounds per square inch absolute
11	micron
ua	microgram
49	morogram

INFORMATION HEREIN IS GIVEN IN GOOD FAITH AS AUTHORITATIVE AND VALID; HOWEVER, NO WARRANTY, EXPRESS OR IMPLIED, CAN BE MADE.

This is the end of MSDS # 1147

COBALT-BASED ALLOYS

A WARNING

Physical Hazards: Non-combustible as supplied. Dust and fines from processing may be ignitable. Explosion/fire hazards may be present when (1) molten metal is in contact with water or moisture or (2) heavily concentrated dust clouds are dispersed in air.

<u>Health Hazards:</u> Health effects generally expected in cases of overexposures: EYES: <u>Dust or fume from processing:</u> Can cause irritation.

SKIN: <u>Dust or fume from processing</u>: Can cause irritation, sensitization and allergic contact dermatitis.

INHALATION: <u>Health effects from mechanical processing (e.g., cutting, grinding)</u>: Can cause upper respiratory tract irritation. **Chronic overexposures**: Can cause asthma, respiratory sensitization, scarring of the lungs (pulmonary fibrosis), central nervous system damage, secondary Parkinson's disease and reproductive harm in males. <u>Additional health effects</u> <u>from elevated temperature processing (e.g., welding, melting)</u>: **Acute overexposures**: Can cause nausea, fever, chills, shortness of breath and malaise (metal fume fever). **Chronic overexposures**: Can cause the accumulation of fluid in the lungs (pulmonary edema) and lung cancer.

WARNING: Cobalt metal powder, Chromium (hexavalent compounds) and nickel (metallic) and nickel compounds are chemicals known to the State of California to cause cancer (Proposition 65).

<u>Precautions</u>: Avoid generating dust. Use with adequate ventilation. Keep material dry. Use appropriate personal protective equipment (safety glasses/gloves) to avoid injury. Use appropriate NIOSH approved respiratory protection (N95) if concentrations exceed the permissible limits.

First Aid (dust or fume from processing): EYES: Flush eyes with plenty of water or saline for at least 15 minutes. Consult a physician. SKIN: Wash skin with soap and water for at least 15 minutes. Consult a physician if irritation persists. INHALATION: Remove to fresh air. If unconscious or severely injured, check for clear airway, breathing and presence of pulse. Perform CPR if there is no pulse or respiration. Consult a physician.

In case of fire: Use a Class D agent, fluxing salts, graphite or dry sand on dust or fine fires. Otherwise, use fire fighting methods and materials that are appropriate for surrounding fire. Do NOT use water around molten metal. This will react with the burning material.

Read Alcoa Material Safety Data Sheet No. 1147 for more information about use and disposal.

Emergency Phone: (412) 553-4001.

INGREDIENTS:
Cobalt
Chromium
Nickel
Tungsten
Iron
Molybdenum
Tantalum

CAS No: (7440-48-4) (7440-47-3) (7440-02-0) (7440-33-7) (7439-89-6) (7439-98-7) (7440-25-7) INGREDIENTS: Vanadium Manganese Aluminum Niobium Silicon Carbon CAS No: (7440-62-2) (7439-96-5) (7429-90-5) (7440-03-1) (7440-21-3) (7440-44-0)

Alcoa Inc.

201 Isabella Street, Pittsburgh, PA 15212-5858 USA

4/08 1147

ERROR: undefined OFFENDING COMMAND: get

STACK:

/quit -dictionary--mark-

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.8 Revision Date 12/01/2015 Print Date 05/13/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Cumene
	Product Number Brand Index-No.	:	36698 Sigma-Aldrich 601-024-00-X
	CAS-No.	:	98-82-8

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226 Carcinogenicity (Category 2), H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Aspiration hazard (Category 1), H304 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s) P201

Obtain special instructions before use.

P202	Do not handle until all safety precautions have been read and understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	Isopropylbenzene
Formula	:	C ₉ H ₁₂
Molecular weight	:	120.19 g/mol
CAS-No.	:	98-82-8
EC-No.	:	202-704-5
Index-No.	:	601-024-00-X

Hazardous components

Component	Classification	Concentration
Cumene		
	Flam. Liq. 3; Carc. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 2; Aquatic Chronic 2; H226, H304, H335, H351, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in

container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

CAS-No.	Value	Control	Basis		
		parameters			
98-82-8	TWA	50.00000 ppm	USA. ACGIH Threshold Limit Values		
			(ILV)		
Remarks	Central Nervous System impairment				
	Upper Respir	ratory Tract irritatio	n		
	Eve irritation				
	Skin irritation				
	TWA	50.000000 ppm	USA. NIOSH Recommended		
		245.000000	Exposure Limits		
		mg/m3			
	Potential for	dermal absorption			
	TWA	VA 50.000000 ppm USA. Occupational Ex			
		245.000000	(OSHA) - Table Z-1 Limits for Air		
		mg/m3	Contaminants		
	Skin designation				
	The value in mg/m3 is approximate.				
	CAS-No. 98-82-8 Remarks	CAS-No. Value 98-82-8 TWA Remarks Central Nerv Upper Respine Eye irritation Skin irritation TWA Potential for TWA Skin designa The value in	CAS-No.ValueControl parameters98-82-8TWA50.000000 ppmRemarksCentral Nervous System impair Upper Respiratory Tract irritationSkin irritationTWA50.000000 ppmSkin irritationTWA50.000000 ppm245.00000 mg/m3Potential for dermal absorptionTWA50.000000 ppm245.00000 mg/m3Skin designation The value in mg/m3 is approxin		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 30 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -96 °C (-141 °F) - lit.
f)	Initial boiling point and boiling range	152 - 154 °C (306 - 309 °F) - lit.
g)	Flash point	31.0 °C (87.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 6.5 %(V) Lower explosion limit: 0.9 %(V)
k)	Vapour pressure	10.7 hPa (8.0 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	0.864 g/cm3 at 25 °C (77 °F)
n)	Water solubility	0.06 g/l at 25 °C (77 °F) - slightly soluble
o)	Partition coefficient: n- octanol/water	log Pow: 3.55 at 23 °C (73 °F)
p)	Auto-ignition temperature	425.0 °C (797.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety information	
	Surface tension	27.69 mN/m at 25 °C (77 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.

- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5** Incompatible materials Strong oxidizing agents

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - male - 2,260 mg/kg

Inhalation: No data available

Dermal: No data available

NOAEL Feed - Rat - male - > 535.8 mg/kg

Skin corrosion/irritation

Skin - Rabbit Result: No skin irritation (OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit Result: No eye irritation (OECD Test Guideline 405)

Respiratory or skin sensitisation

- Guinea pig Result: Did not cause sensitisation on laboratory animals. (OECD Test Guideline 406)

Germ cell mutagenicity

in vitro assay S. typhimurium Result: negative

Mutagenicity (micronucleus test) Mouse - male and female Result: negative

Carcinogenicity

IARC: 2B - Group 2B: Possibly carcinogenic to humans (Cumene)

NTP: Reasonably anticipated to be a human carcinogen (Cumene)

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure May cause respiratory irritation.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

May be fatal if swallowed and enters airways.

Additional Information

RTECS: GR8575000

narcosis, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Damage to the lungs., Liver injury may occur., Kidney injury may occur.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 4.8 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia (water flea) - 2.14 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 2.60 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability Result: - According to the results of tests of biodegradability this product is not readily biodegradable.

No data available

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1918 Class: 3 Proper shipping name: Isopropylbenzene Reportable Quantity (RQ): 5000 lbs Packing group: III

Poison Inhalation Hazard: No

IMDG

UN number: 1918 Class: 3 Packing group: III Proper shipping name: ISOPROPYLBENZENE Marine pollutant:yes IATA EMS-No: F-E, S-E

15. REGULATORY INFORMATION

SARA 302 Components No chemicals in this material are subject to the reporting require	rements of SARA Tit	le III, Section 302.
SARA 313 Components The following components are subject to reporting levels estab	blished by SARA Title	e III, Section 313: Revision Date
Cumene	98-82-8	2007-07-01
SARA 311/312 Hazards Fire Hazard, Acute Health Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
Cumene	CAS-No. 98-82-8	Revision Date 2007-07-01
Pennsylvania Right To Know Components		
Cumene	CAS-No. 98-82-8	Revision Date 2007-07-01
New Jersey Right To Know Components		
Cumene	CAS-No. 98-82-8	Revision Date 2007-07-01
California Prop. 65 Components WARNING! This product contains a chemical known to the State of California to cause cancer. Cumene	CAS-No. 98-82-8	Revision Date 2010-06-11

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute Aquatic Chronic Asp. Tox. Carc. Flam. Liq. H226 H304 H335 H351 H401	Acute aquatic toxicity Chronic aquatic toxicity Aspiration hazard Carcinogenicity Flammable liquids Flammable liquid and vapour. May be fatal if swallowed and enters airways. May cause respiratory irritation. Suspected of causing cancer. Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.
HMIS Rating Health hazard: Chronic Health Haza Flammability: Physical Hazard	2 ard: * 3 0
NFPA Rating Health hazard: Fire Hazard: Reactivity Hazard:	2 3 0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.8

Revision Date: 12/01/2015

Print Date: 05/13/2016



Cyanide (cas 57-12-5) MSDS

MSDS	: Cyanide
CAS SYNONYMS	: 57-12-5 : * Carbon nitride ion (CN(sup 1-))
	* Cyanide(1-)
	* Cyanide, dry (UN1588)
	* Cyanide anion
	* Cyanide (CN(sup 1-))
	* Cyanide ion
	* Cyanide(1-) ion
	* Cyanure
	* Isocyanide

* RCRA waste number P030

Catalog of Chemical Suppliers, Buyers, Custom Synthesis Companies And Equipment Manufacturers [Cyanide 57-12-5]

*** CHEMICAL IDENTIFICATION ***

RTECS NUMBER	:	GS7175000
CHEMICAL NAME	:	Cyanide
CAS REGISTRY NUMBER	:	57-12-5
BEILSTEIN REFERENCE NO.	:	1900509
LAST UPDATED		199710
DATA ITEMS CITED	:	31
MOLECULAR FORMULA	:	C-N
MOLECULAR WEIGHT	:	26.02
WISWESSER LINE NOTATION	:	H CN
SYNONYMS/TRADE NAMES :		

- * Carbon nitride ion (CN(sup 1-))
- * Cyanide(1-)
- * Cyanide, dry (UN1588)
- * Cyanide anion
- * Cyanide (CN(sup 1-))
- * Cyanide ion
- * Cyanide(1-) ion
- * Cyanure

- * Isocyanide
- * RCRA waste number P030

*** HEALTH HAZARD DATA ***

** ACUTE TOXICITY DATA **

TYPE OF TEST	: LD50 - Lethal dose, 50 percent kill				
ROUTE OF EXPOSURE	: Intraperitoneal				
SPECIES OBSERVED	: Rodent - mouse				
DOSE/DURATION	: 3 mg/kg				
TOXIC EFFECTS :					
Behavioral - tremor					
Behavioral - convulsions or effect on seizure threshold					
Lungs, Thorax, or Respiration - dyspnea					
REFERENCE :					

NATUAS Nature. (Nature Subscription Dept., POB 1018, Manasguan, NJ 08736) V.1- 1869- Volume(issue)/page/year: 228,1315,1970

*** REVIEWS ***

TOXICOLOGY REVIEW

CLCHAU Clinical Chemistry (Winston-Salem, NC). (American Assoc. for Clinical Chemistry, 1725 K St., NW, Washington, DC 20006) V.1- 1955-Volume(issue)/page/year: 19,361,1973

*** U.S. STANDARDS AND REGULATIONS ***

MSHA STANDARD-air:TWA 5 mg/m3 (skin) DTLVS* The Threshold Limit Values (TLVs) and Biological Exposure Indices (BEIs) booklet issues by American Conference of Governmental Industrial Hygienists (ACGIH), Cincinnati, OH, 1996 Volume(issue)/page/year: 3,64,1971

OSHA PEL (Gen Indu):8H TWA 5 mg(CN)/m3 CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 29,1910.1000,1994

OSHA PEL (Construc):8H TWA 5 mg(CN)/m3 CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 29,1926.55,1994 OSHA PEL (Shipyard):8H TWA 5 mg(CN)/m3 CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 29,1915.1000,1993

OSHA PEL (Fed Cont):8H TWA 5 mg(CN)/m3 CFRGBR Code of Federal Regulations. (U.S. Government Printing Office, Supt. of Documents, Washington, DC 20402) Volume(issue)/page/year: 41,50-204.50,1994

*** OCCUPATIONAL EXPOSURE LIMITS ***

OEL-ARAB Republic of Egypt:TWA 5 mg/m3;Skin JAN 1993

OEL-AUSTRALIA:TWA 5 mg/m3;Skin JAN 1993

OEL-AUSTRIA:TWA 5 mg/m3;Skin JAN 1993

OEL-DENMARK:TWA 5 mg/m3;Skin JAN 1993

OEL-FINLAND:TWA 5 mg/m3;STEL 10 mg/m3 JAN 1993

OEL-FRANCE:TWA 5 mg/m3;Skin JAN 1993

OEL-GERMANY:TWA 5 mg/m3;Skin JAN 1993

OEL-HUNGARY:TWA 0.3 mg/m3;STEL 0.6 mg/m3;Skin JAN 1993

OEL-INDIA:TWA 4 mg/m3;Skin JAN 1993

OEL-THE NETHERLANDS:TWA 5 mg/m3;Skin JAN 1993

OEL-THE PHILIPPINES:TWA 5 mg/m3;Skin JAN 1993

OEL-POLAND:TWA 0.3 mg/m3 JAN 1993

OEL-SWEDEN:STEL 5 mg/m3;Skin JAN 1993

OEL-SWITZERLAND:TWA 5 mg/m3;STEL 10 mg/m3;Skin JAN 1993

OEL-THAILAND:TWA 5 mg/m3 JAN 1993

OEL-UNITED KINGDOM:TWA 5 mg/m3;Skin JAN 1993

*** NIOSH STANDARDS DEVELOPMENT AND SURVEILLANCE DATA ***

NIOSH RECOMMENDED EXPOSURE LEVEL (REL) :

NIOSH REL TO CYANIDE-air:CL 4.7 ppm(CN)/10M

REFERENCE :

NIOSH* National Institute for Occupational Safety and Health, U.S. Dept. of Health, Education, and Welfare, Reports and Memoranda. Volume(issue)/page/year: DHHS #92-100,1992

NIOSH OCCUPATIONAL EXPOSURE SURVEY DATA :

NOES - National Occupational Exposure Survey (1983)
NOES Hazard Code - X3010
No. of Facilities: 8 (estimated)
No. of Industries: 1
No. of Occupations: 1

No. of Employees: 367 (estimated)

No. of Female Employees: 120 (estimated)

*** STATUS IN U.S. ***

ATSDR TOXICOLOGY PROFILE

NTIS** National Technical Information Service. (Springfield, VA 22161) Formerly U.S. Clearinghouse for Scientific & Technical Information. Volume(issue)/page/year: PB/90/162058/AS

EPA TSCA Section 8(b) CHEMICAL INVENTORY

EPA TSCA Section 8(d) unpublished health/safety studies

On EPA IRIS database

EPA TSCA TEST SUBMISSION (TSCATS) DATA BASE, JUNE 1998

OSHA ANALYTICAL METHOD #ID-120

*** END OF RECORD ***

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.8 Revision Date 03/07/2015 Print Date 02/23/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Cyclohexane		
	Product Number Brand Index-No.	:	320633 Aldrich 601-017-00-1		
	CAS-No.	:	110-82-7		
1.2	Relevant identified uses of the substance or mixture and uses advised against				
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		

1.4 Emergency telephone number

Emergency Phone #	:	(314)	776-6555
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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Skin irritation (Category 2), H315 Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336 Aspiration hazard (Category 1), H304 Acute aquatic toxicity (Category 1), H400

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.

P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: C ₆ H ₁₂
Molecular weight	: 84.16 g/mol
CAS-No.	: 110-82-7
EC-No.	: 203-806-2
Index-No.	: 601-017-00-

Hazardous components

Component	Classification	Concentration
Cyclohexane		
	Flam. Liq. 2; Skin Irrit. 2;	<= 100 %
	STOT SE 3; Asp. Tox. 1;	
	Aquatic Acute 1; H225, H304,	
	H315, H336, H400	
Easth a full a staff a LL Orate was to sea the sea LL ship of	<i>i</i> 0 <i>i</i> 10	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture No data available

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

- **6.3** Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).
- 6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities
 Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully
 resealed and kept upright to prevent leakage.
 Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Cyclohexane	110-82-7	TWA	100.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nerv	ous System impair	ment
		TWA	300.000000 ppm 1,050.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	300.000000 ppm 1,050.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in	mg/m3 is approxir	nate.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 35 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 4 - 7 °C (39 - 45 °F) - lit.
f)	Initial boiling point and boiling range	80.7 °C (177.3 °F) - lit.
g)	Flash point	-17.99 °C (-0.38 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 9 %(V) Lower explosion limit: 1 %(V)
k)	Vapour pressure	225.0 hPa (168.8 mmHg) at 37.7 °C (99.9 °F) 102.7 hPa (77.0 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	0.779 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	log Pow: 3.44
p)	Auto-ignition temperature	260.0 °C (500.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

10.2 Chemical stability Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks.

10.5 Incompatible materials Strong oxidizing agents

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 12,705 mg/kg

LC50 Inhalation - Rat - 4 h - 34,000 mg/l (OECD Test Guideline 403)

LD50 Dermal - Rabbit - > 2,000 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit Result: No skin irritation

Serious eye damage/eye irritation Eyes - Rabbit

Result: Mild eye irritation

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard May be fatal if swallowed and enters airways.

Additional Information

RTECS: GU6300000

Central nervous system depression, Drowsiness, Irritability, Dizziness, Gastrointestinal disturbance, Lung irritation, chest pain, pulmonary edema

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish

flow-through test LC50 - Pimephales promelas (fathead minnow) - 4.53 mg/l -

96 h

(OECD Test Guideline 203)

Toxicity to daphnia and other aquatic invertebrates	Immobilization EC50 - Daphnia magna (Water flea) - 0.9 mg/l - 48 h (OECD Test Guideline 202)	
	ECE0 Decudekirchnerielle subsenitete (green elges) 2.4 mg/l 72	۲ –

Toxicity to algae EC50 - Pseudokirchneriella subcapitata (green algae) - 3.4 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability Biodegradability Result: -

Result: - Readily biodegradable

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

SARA 302 Compone No chemicals in this r	ents naterial are subject to t	he reporting requirements o	f SARA Title III, Section 302.	
Proper shipping name	: Cyclohexane			
Proper shipping name Marine pollutant:yes IATA UN number: 1145	Class: 3	Packing group: II		
IMDG UN number: 1145	Class: 3	Packing group: II	EMS-No: F-E, S-D	
Poison Inhalation Haz	ard: No			
UN number: 1145 Proper shipping name Reportable Quantity (I	Class: 3 :: Cyclohexane RQ): 1000 lbs	Packing group: II		
001 (03)				

SARA 313 Components

The following components are subject to reporting I	evels established by SARA Title III,	Section 313:
	CAS-No.	Revision Date
Cyclohexane	110-82-7	2007-07-01

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard

15.

Massachusetts Right To Know Components

CAS-No.	Revision Date
110-82-7	2007-07-01
CAS-No.	Revision Date
110-82-7	2007-07-01
CAS-No.	Revision Date
110-82-7	2007-07-01
	CAS-No. 110-82-7 CAS-No. 110-82-7 CAS-No. 110-82-7

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
Skin Irrit.	Skin irritation
STOT SE	Specific target organ toxicity - single exposure

0

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	
Flammability:	3
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	3

Reactivity Hazard:

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.8

Revision Date: 03/07/2015

Print Date: 02/23/2016

Chem Service Inc.

Last Revision Date: 1/11/2012

SECTION 1 - CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Catalog Number:	M-CSM8080U99
Description:	Pesticide Control Sample Mixture in Toluene
Product is:	Mixture

Supplied by CHEM SERVICE, Inc. PO BOX 599, WEST CHESTER, PA 19381 (610)-692-3026 EMERGENCY PHONE: 1-610-692-3026

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS

The following compounds are contained in this mixture at the stated concentrations:

<u>CONC</u>	ANALYTE	CAS
100ug/ml	4,4'-DDD	72-54-8
100ug/ml	4,4'-DDT	50-29-3
100ug/ml	b-Endosulfan	33213-65-9
100ug/ml	Endosulfan sulfate	1031-07-8
100ug/ml	Endrin	72-20-8
20ug/ml	Heptachlor	76-44-8
20ug/ml	BHC (alpha isomer)	319-84-6
20ug/ml	BHC (beta isomer)	319-85-7
20ug/ml	a-Endosulfan	959-98-8
20ug/ml	Heptachlor epoxide (Isomer B)	1024-57-3
20ug/ml	Aldrin	309-00-2
20ug/ml	Dieldrin	60-57-1
20ug/ml	4,4'-DDE	72-55-9

SECTION 3 - HAZARDS IDENTIFICATION

Contact lenses should not be worn in the laboratory. All chemicals should be considered hazardous - Avoid direct physical contact!

For the solvent: Toluene

Can cause eye irritation. Prolonged exposure may cause nausea/headache/dizziness and/or eye damage. May be harmful if inhaled. Dust and/or vapors can cause irritation to respiratory tract. Can be irritating to mucous membranes.

May be harmful if swallowed. Can cause gastro-intestinal disturbances. Can cause blood disorders. Exposure can cause liver damage. Exposure can cause kidney damage.

Can cause skin irritation. May be harmful if absorbed through the skin. May be rapidly absorbed through the skin with potential adverse health effects.

Can cause delayed adverse health effects. Can cause nervous system injury.

Avoid consumption of alcohol before and after handling of this compound because it will increase the toxicity of the compound. Narcotic at high concentrations.

This chemical is considered to cause DEVELOPMENTAL TOXICITY by the state of California.

SECTION 4 - FIRST AID MEASURES

An antidote is a substance intended to counteract the effect of a poison. It should be administered only by a physician or trained emergency personnel. Medical advice can be obtained from a POISON CONTROL CENTER.

Chem Service Inc.

MATERIAL SAFETY DATA SHEET

For the solvent: Toluene

In case of contact: Flush eyes continuously with water for 15-20 minutes. Flush skin with water for 15-20 minutes. If no burns have occurred-use soap and water to cleanse skin. If inhaled remove patient to fresh air. Administer oxygen if patient is having difficulty breathing. If patient has stopped breathing administer artificial respirations. If patient is in cardiac arrest administer CPR. Continue life supporting measures until medical assistance has arrived. Contact Poison Control Center immediately if necessary.

Remove and wash contaminated clothing. If patient is exhibiting signs of shock - Keep warm and quiet.

If swallowed DO NOT induce vomiting. If taken internally give milk, milk of magnesia or egg whites beaten with water. Do not administer liquids or induce vomiting to an unconscious or convulsing person. If patient is vomiting-watch closely to make sure airway does not become obstructed by vomit.

Get medical attention if necessary.

SECTION 5 - FIRE AND EXPLOSION DATA

For the solvent: Toluene	
Flash Point:	4.4°C
Lower Explosion Limit:	1.2%
Upper Explosion Limit:	7%
Autoignition Temperature:	535°C
NFPA Scale:	0 - Least, 1 - Slight, 2 - Moderate, 3 - High, 4 - Severe
NFPA Hazard Rating:	Health: 2, Reactivity: 0, Flammability: 3

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spills or Leaks: Evacuate area. Wear appropriate OSHA regulated equipment. Ventilate area. Absorb on vermiculite or similar material. Sweep up and place in an appropriate container. Hold for disposal.

Wash contaminated surfaces to remove any residue.

Remove contaminated clothing and wash before reuse.

SECTION 7 - HANDLING AND STORAGE

<u>Handling</u>: This chemical should be handled only in a hood. Eye shields should be worn. Use appropriate OSHA/MSHA approved safety equipment. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation. Wash thoroughly after handling.

<u>Storage</u>: Store in a cool dry place. Store only with compatible chemicals. Keep tightly closed.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

For the solvent: Toluene OSHA PEL (TWA): ACGIH TLV (TWA): ACGIH TLV (STEL):

100 ppm (375mg/m3) 50ppm (147mg/m3) Data Not Available

Personal Protective Equipment Eyes: Wear Safety Glasses. Skin: Wear appropriate protective gloves to prevent skin exposure. Clothing: Wear appropriate protective clothing to minimize contact with skin. Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 requirements must be followed whenever workplace conditions warrant the use of a respirator.

MATERIAL SAFETY DATA SHEET

Chem Service Inc.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

For the solvent: Toluene	
Color:	Colorless
Phase:	Liquid
Melting Point:	-95°C
Boiling Point:	110.6°C
Specific Gravity:	0.866g/mL @ 20°C
Vapor Density:	2.9
Vapor Preasure:	29.1hPa @ 20°C
Solubility in Water:	Very slightly soluble
Odor:	Aromatic
Evaporation Rate (Butyl acetate=1):	1.9
Molecular Weight:	92.14
Molecular Formula:	C7H8

SECTION 10 - STABILITY AND REACTIVITY

For the solvent: Toluene

Flammable. Readily absorbed and retained on clothing and/or shoes. Volatile. Incompatible with strong oxidizing agents. Decomposition liberates toxic fumes. Hygroscopic.

SECTION 11 - TOXICOLOGY INFORMATION

Since this solution contains a very low concentration of active component, the primary hazard is from the solvent.

The LD50 for the minor component:

C 4 C		
CAS		LD <u>50</u>
72-54-8	113	mg/kg
50-29-3	87	mg/kg
33213-65-9	240	mg/kg
1031-07-8	18	mg/kg
72-20-8	8	mg/kg
76-44-8	40	mg/kg
319-84-6	177	mg/kg
319-85-7	6,000	mg/kg
959-98-8	76	mg/kg
1024-57-3	15	mg/kg
309-00-2	38	mg/kg
60-57-1	38	mg/kg
72-55-9	880	mg/kg
XS5250000		
5000.0 mg/kg		
N/A mg/kg		
49 g/m3(4h)		
NO		
NO Details: 3		
	CAS 72-54-8 50-29-3 33213-65-9 1031-07-8 72-20-8 76-44-8 319-84-6 319-85-7 959-98-8 1024-57-3 309-00-2 60-57-1 72-55-9 XS5250000 5000.0 mg/kg N/A mg/kg 49 g/m3(4h)	CAS 72-54-8 113 50-29-3 87 33213-65-9 240 1031-07-8 18 72-20-8 8 76-44-8 40 319-84-6 177 319-85-7 6,000 959-98-8 76 1024-57-3 15 309-00-2 38 60-57-1 38 72-55-9 880 XS5250000 5000.0 mg/kg N/A mg/kg 49 g/m3(4h) NO NO Details: 3
Chem Service Inc.

MATERIAL SAFETY DATA SHEET

NTP:	NO
ACGIH:	NO Details: A4
NIOSH:	NO
Other:	NO

Property 65: This chemical is considered to cause DEVELOPMENTAL TOXICITY by the state of California.

Carcinogenicity

For the minor component:

4,4'-DDD	<u>OSHA</u> No	<u>NTP</u> No	IARC Yes	<u>NIOSH</u> No	<u>ACGIH</u> No
4,4'-DDT	<u>OSHA</u> No	<u>NTP</u> Yes	IARC Yes	NIOSH Yes	<u>ACGIH</u> No
Heptachlor	<u>OSHA</u> No	<u>NTP</u> No	IARC Yes	<u>NIOSH</u> Yes	ACGIH Yes
BHC (alpha isomer)	<u>OSHA</u> No	<u>NTP</u> No	<u>IARC</u> Yes	<u>NIOSH</u> No	<u>ACGIH</u> No
BHC (beta isomer)	<u>OSHA</u> No	<u>NTP</u> Yes	IARC Yes	<u>NIOSH</u> No	<u>ACGIH</u> No
Heptachlor epoxide (Isomer B)	<u>OSHA</u> No	<u>NTP</u> No	IARC Yes	<u>NIOSH</u> No	<u>ACGIH</u> No
Aldrin	<u>OSHA</u> No	<u>NTP</u> No	<u>IARC</u> No	<u>NIOSH</u> Yes	<u>ACGIH</u> No
Dieldrin	<u>OSHA</u> No	<u>NTP</u> No	<u>IARC</u> No	<u>NIOSH</u> Yes	<u>ACGIH</u> No
4,4'-DDE	<u>OSHA</u> No	<u>NTP</u> No	IARC Yes	<u>NIOSH</u> No	<u>ACGIH</u> No

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity: Not Available Environmental Fate: Not Available

SECTION 13 - DISPOSAL CONSIDERATIONS

Disposal: Dispose in accordance with Federal, State and Local regulations.

SECTION 14 - TRANSPORTATION INFORMATION

UN1294
3
II
Toluene

SECTION 15 - REGULATORY INFORMATION

For the solvent: Toluene European Labeling in Accordance with EC Directives

Hazard Symbols: F, Xn

Risk Phrases: -R11: Highly Flammable. -R20: Harmful by inhalation.

Safety Phrases: -S16: Keep away from sources of ignition - No smoking. -S25: Avoid contact with the eyes. -S29: Do not empty into drains.

-S33: Take precautionary measures against static discharges.

Chem Service Inc.

SECTION 16 - OTHER INFORMATION

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded MSDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

Persons not specifically and properly trained should not handle this chemical or its container. This product is furnished FOR LABORATORY USE ONLY! Our products may NOT BE USED as drugs, cosmetics, agricultural or pesticide products, food additives or as household chemicals.

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This product is furnished FOR LABORATORY USE ONLY!

Chem Service Inc. Material Safety Data Sheet

Last Revised On: 11/3/2011

SECTION 1 - CHEMICAL PRODUCT and COMPANY IDENTIFICATION

Catalog Number:	S-10875M1
Description:	4,4'-DDE
Product is:	Solution
Other Name(s):	1,1-Dichloro-2,2-bis[p-chlorophenyl]ethylene/p,p'-DDE/1,1 -(Dichloroethenylidene)bis[4-chlorobenzene]

Supplied by CHEM SERVICE, Inc. PO BOX 599, WEST CHESTER, PA 19381 (610)-692-3026 EMERGENCY PHONE: 1-610-692-3026

SECTION 2 - COMPOSITION, INFORMATION ON INGREDIENTS

CAS No.:	72-55-9
Description:	4,4'-DDE Solution
Concentration:	100ug/mL in Methanol
EINECS No.:	200-784-6
Hazard Symbols:	XN

SECTION 3 - HAZARDS IDENTIFICATION

Contact lenses should not be worn in the laboratory. All chemicals should be considered hazardous - Avoid direct physical contact!

For the solvent: Methanol

Health Risks: May be fatal if absorbed through the skin! Repeated exposure to vapors and/or dust can cause eye injury. May be fatal if inhaled! Can cause cardiovascular system injury. Exposure can cause liver damage. Exposure can cause kidney damage. May be fatal or cause blindness if swallowed. Can cause gastro-intestinal disturbances. Can cause convulsions.

Property 65: Data Not Available

SECTION 4 - FIRST AID MEASURES

An antidote is a substance intended to counteract the effect of a poison. It should be administered only by a physician or trained emergency personnel. Medical advice can be obtained from a POISON CONTROL CENTER.

For the solvent: Methanol

First Aid: In case of contact: Flush eyes continuously with water for 15-20 minutes. Flush skin with water for 15-20 minutes. If patient has stopped breathing administer artificial respiration. If patient is in cardiac arrest administer CPR. Continue life supporting measures until medical assistance has arrived. Do not wear shoes or clothing until absolutely free of all chemical odors. Get medical attention if necessary. If no burns have occurred-use soap and water to cleanse skin. If inhaled remove patient to fresh air. Administer oxygen if patient is having difficulty breathing. If swallowed do not induce vomiting.

SECTION 5 - FIRE AND EXPLOSION DATA

For the solvent: Methanol

Flash Point: 11°C This is a flammable chemical. Extinguishing Media: Carbon dioxide or dry chemical powder. DO NOT USE WATER! Upper Explosion Limit: 36% Lower Explosion Limit: 6.0% Autoignition Temperature: 464°C

NFPA Scale: 0 - Least, 1 - Slight, 2 - Moderate, 3 - High, 4 - Severe NFPA Hazard Rating: Health: 1. Reactivity: 0. Flammability: 3. Special: No Data.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

Spills or Leaks: Evacuate area. Wear appropriate OSHA regulated equipment. Ventilate area. Absorb on vermiculite or similar material. Sweep up and place in an appropriate container. Hold for disposal.

Wash contaminated surfaces to remove any residue. Remove contaminated clothing and wash before reuse.

SECTION 7 - HANDLING AND STORAGE

Handling: This chemical should be handled only in a hood. Eye shields should be worn. Use appropriate OSHA/MSHA approved safety equipment. Avoid contact with skin, eyes and clothing. Avoid ingestion and inhalation. Wash thoroughly after handling.

Storage: Store in a cool dry place. Store only with compatible chemicals. Keep tightly closed.

SECTION 8 - EXPOSURE CONTROLS/PERSONAL PROTECTION

For the solvent: Methanol

OSHA PEL (TWA):	200 ppm (260 mg/m3)
ACGIH TLV (TWA):	200 ppm (262 mg/m3)
ACGIH TLV (STEL):	Data Not Available

Personal Protective Equipment

Eyes: Wear Safety Glasses.

Skin: Wear appropriate protective gloves to prevent skin exposure. Clothing: Wear appropriate protective clothing to minimize contact with skin. Respirators: A respiratory protection program that meets OSHA's 29 CFR 1910.134 requirements must be followed whenever workplace conditions warrant a respirators use.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

For the solvent: Methanol

Color:	Colorless
Phase:	Liquid
Melting Point:	-98°C
Boiling Point:	64.6°C
Specific Gravity:	0.791g/mL
Vapor Density:	1.11
Vapor Pressure:	130.3 hPa @ 20°C
Solubility in Water:	Completely miscible.
Odor:	Data Not Available
Evaporation Rate (Butyl	acetate=1): Data Not Available

Molecular Weight: 32.05 Molecular Formula: CH4O

SECTION 10 - STABILITY AND REACTIVITY

For the solvent: Methanol

Reacts with Acid halides and anhydrides. Flammable. Incompatible with strong acids. Incompatible with strong reducing agents. Incompatible with strong oxidizing agents. Decomposition liberates toxic fumes. Hygroscopic. Incompatible with active metals (e.g. Sodium).

SECTION 11 - TOXICOLOGY INFORMATION

The primary hazards for this solution are predominantly from the solvent.

For the solvent: Methanol

RTECS: PC1400000 Oral Rat or Mouse LD50: 5628 mg/kg Dermal Rat or Mouse LD50: N/A mg/kg Rat or Mouse LC50 : 64000 ppm/8H Carcinogenicity OSHA: NO IARC: NO NTP: NO ACGIH: NO NIOSH: NO Other: NO

Property 65: Data Not Available

SECTION 12 - ECOLOGICAL INFORMATION

Ecotoxicity: Not Available Environmental Fate: Not Available

SECTION 13 - DISPOSAL CONSIDERATIONS

Disposal: Dispose in accordance with Federal, State and Local regulations.

SECTION 14 - TRANSPORTATION INFORMATION

For the solvent: Methanol

UN Number: UN1230 Class: 3 Packing Group: II Proper Shipping Name: Methanol

SECTION 15 - REGULATORY INFORMATION

For the solvent: Methanol

European Labeling in Accordance with EC Directives Hazard Symbols: T F Risk Phrases R11 Highly Flammable. R23/25 Toxic by inhalation and if swallowed.

Safety Phrases

S16	Keep away from sources of ignition- No smoking.
S2	Keep out of reach of children.

- S24 Avoid contact with the skin.
- S45 In case of accident or if you feel unwell, seek medical advice immediately (show label where possible).
- S7 Keep container tightly closed

SECTION 16 - OTHER INFORMATION

The above information is believed to be correct on the date it was last revised and must not be considered all inclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. OSHA regulations require that if other hazards become evident, an upgraded MSDS must be made available to the employee within three months. RESPONSIBILITY for updates lies with the employer and not with CHEM SERVICE, Inc.

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Safety data for dibenz(a,h)anthracene



Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

Synonyms: 1,2:5,6-benzanthracene, 1,2:5,6-dibenzanthracene, dibenzo(a,h) anthracene, DBA, 1,2,5,6-DBA Use: a common pollutant in smoke and used oils Molecular formula: $C_{22}H_{14}$

CAS No: 53-70-3 EINECS No: 200-181-8 Annex I Index. No: 601-041-00-2

Physical data

Appearance: white to light yellow crystalline solid Melting point: 266 - 267 C Boiling point: 524 C Vapour density: Vapour pressure: Density (g cm⁻³): 1.28 Flash point: Explosion limits: Autoignition temperature: Water solubility:

Stability

Stable. Combustible. Incompatible with strong oxidizing agents.

Toxicology

Harmful if swallowed or inhaled. Experimental carcinogen, tumorigen and neoplastigen. IARC probable human carcinogen.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given <u>here.</u>) $NN MUS I DI O 10 mg kg^{-1}$

IVN-MUS LDLO 10 mg kg⁻¹

Risk phrases

(The meaning of any risk phrases which appear in this section is given <u>here.</u>) R45 R50 R53.

Environmental information

Harmful in the environment - may cause long-term damage.

Transport information

(The meaning of any UN hazard codes which appear in this section is given <u>here.</u>)

Non-hazardous for air, sea and road freight.

Personal protection

Safety glasses, gloves, good ventilation. Handle as a possible carcinogen.

Safety phrases

(The meaning of any safety phrases which appear in this section is given <u>here.</u>) S45 S53 S60 S61.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

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sigma-aldrich.com

SAFETY DATA SHEET

Version 3.7 Revision Date 11/25/2014 Print Date 01/29/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Dibenzofuran		
	Product Number Brand	:	236373 Aldrich		
	CAS-No.	:	132-64-9		
1.2	Relevant identified uses o	f th	e substance or mixture and uses advised against		
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the	he :	safety data sheet		
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052		

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Warning
Hazard statement(s) H302 H411	Harmful if swallowed. Toxic to aquatic life with long lasting effects.
Precautionary statement(s) P264 P270 P273 P301 + P312 + P330	Wash skin thoroughly after handling. Do not eat, drink or smoke when using this product. Avoid release to the environment. IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you
P391 P501	feel unwell. Rinse mouth. Collect spillage. Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula : C ₁₂ H ₈ O Molecular weight : 168.19 g/mol CAS-No. : 132-64-9 EC-No. : 205-071-3	Synonyms	: Diphenylene	oxide
LO-NO 203-071-3	Formula Molecular weight CAS-No. EC-No	: C ₁₂ H ₈ O : 168.19 g/mol : 132-64-9 : 205-071-3	
	20110	. 200 011 0	

Hazardous components

Component	Classification	Concentration
Dibenzofuran		
	Acute Tox. 4; Aquatic Acute 2; Aquatic Chronic 2; H302, H411	<= 100 %
For the full toxt of the U. Statements montioned in this S	action and Contian 16	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an

industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: white, beige
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 80 - 82 °C (176 - 180 °F) - lit.
f)	Initial boiling point and boiling range	154 - 155 °C (309 - 311 °F) at 27 hPa (20 mmHg) - lit.
g)	Flash point	130.0 °C (266.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	log Pow: 3.77
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	er safety information	

9.2

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3** Possibility of hazardous reactions No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

The preceding data, or interpretation of data, was determined using Quantitative Structure Activity Relationship (QSAR) modeling.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information

RTECS: HP4430000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish NOEC - Cyprinodon variegatus (sheepshead minnow) - 1 mg/l - 96.0 h

LC50 - Pimephales promelas (fathead minnow) - 1.05 mg/l - 96.0 h

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenzofuran) Reportable Quantity (RQ): 100 lbs Marine pollutant:yes Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (Dibenzofuran) Marine pollutant:yes IATA UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (Dibenzofuran)

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

CAS-No. Revision Date

Dibenzofuran	132-64-9	2007-07-01
SARA 311/312 Hazards Acute Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Dibenzofuran	132-64-9	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Dibenzofuran	132-64-9	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Dibenzofuran	132-64-9	2007-07-01
California Dron. 65 Componente		

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Aquatic Acute	Acute toxicity Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Н302	Harmful if swallowed.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1	
Chronic Health Hazard:		
Flammability:	1	
Physical Hazard	0	
NFPA Rating		
Health hazard:	2	
Fire Hazard:	1	
Reactivity Hazard:	0	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.7

Revision Date: 11/25/2014

Print Date: 01/29/2016

SAFETY DATA SHEET

Airgas.

Halocarbon R-12 (Dichlorodifluoromethane)

Section 1. Identification

GHS product identifier	÷	Halocarbon R-12 (Dichlorodifluoromethane)
Chemical name	\$	dichlorodifluoromethane
Other means of identification	:	ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12
Product use	;	Synthetic/Analytical chemistry.
Synonym	:	ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12
SDS #	÷	001018
Supplier's details	:	Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Emergency telephone number (with hours of operation)	:	1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	GASES UNDER PRESSURE - Liquefied gas HAZARDOUS TO THE OZONE LAYER - Category 1
GHS label elements	
Hazard pictograms	
Signal word	Warning
Hazard statements	Contains gas under pressure; may explode if heated. May cause frostbite. May displace oxygen and cause rapid suffocation. Harms public health and the environment by destroying ozone in the upper atmosphere.
Precautionary statements	
General	Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position.
Prevention	Use and store only outdoors or in a well ventilated place.
Response	Not applicable.
Storage	Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal	Refer to manufacturer/supplier for information on recovery/recycling.
Date of issue/Date of revision	: 5/21/2015. Date of previous issue : 5/21/2015. Version : 2 1/1

Section 2. Hazards identification

Hazards not otherwise classified

: Liquid can cause burns similar to frostbite.

Section 3. Composition/information on ingredients

Substance/mixture	Substance
Chemical name	dichlorodifluoromethane
Other means of identification	ASPEN R-12, Methane, dichlorodifluoro-; Refrigerant 12; Propellant 12; Halon 122; Genetron 12; Freon 12; Fluorocarbon 12; Difluorodichloromethane; DICHLORODIFLUOROMETHANE (FC 12); CFC-12

CAS number/other identifiers

CAS number	: 75-71-8		
Product code	: 001018		
Ingredient name		%	CAS number
Methane, dichlorodifluoro-		100	75-71-8

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.
Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. In case of contact with liquid, warm frozen tissues slowly with lukewarm water and get medical attention. Do not rub affected area. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Get medical attention if adverse health effects persist or are severe. Ingestion of liquid can cause burns similar to frostbite. If frostbite occurs, get medical attention. Never give anything by mouth to an unconscious person. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband. As this product rapidly becomes a gas when released, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health eff	<u>ects</u>						
Eye contact	:	Liquid can c	cause burns similar to fro	ostbite.			
Inhalation	:	Exposure to be delayed	o decomposition product following exposure.	s may cause a healt	h hazard. Serio	us effe	cts may
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Section 4. First aid measures

Skin contact	: Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.
Frostbite	: Try to warm up the frozen tissues and seek medical attention.
Ingestion	: Ingestion of liquid can cause burns similar to frostbite.
Over-exposure signs/sym	<u>ptoms</u>
Eye contact	: Adverse symptoms may include the following: frostbite
Inhalation	: No specific data.
Skin contact	: Adverse symptoms may include the following: frostbite
Ingestion	: Adverse symptoms may include the following: frostbite
Indication of immediate me	dical attention and special treatment needed, if necessary
Notes to physician	 In case of inhalation of decomposition products in a fire, symptoms may be delayed. The exposed person may need to be kept under medical surveillance for 48 hours.
Specific treatments	: No specific treatment.
Protection of first-aiders	: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures **Extinguishing media** Suitable extinguishing : Use an extinguishing agent suitable for the surrounding fire. media Unsuitable extinguishing : None known. media Specific hazards arising : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and from the chemical the container may burst or explode. **Hazardous thermal** : Decomposition products may include the following materials: carbon dioxide decomposition products carbon monoxide halogenated compounds carbonyl halides **Special protective actions** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable for fire-fighters training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. **Special protective** Fire-fighters should wear appropriate protective equipment and self-contained breathing ÷. equipment for fire-fighters apparatus (SCBA) with a full face-piece operated in positive pressure mode. For incidents involving large quantities, thermally insulated undergarments and thick textile or leather gloves should be worn.

Section 6. Accidental release measures

Personal precautions, protective equipment and emergency procedures		
For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Do not touch or walk through spilled material. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	:	Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air). May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill	: Immediately contact emergency personnel. Stop leak if without risk.
Large spill	: Immediately contact emergency personnel. Stop leak if without risk. Note: see Section 1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Protective measures	: Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Do not get in eyes or on skin or clothing. Avoid breathing gas. Avoid release to the environment. Refer to special instructions/safety data sheet. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.
Advice on general occupational hygiene	: Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.
Conditions for safe storage, including any incompatibilities	: Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

<u>Control parameters</u> <u>Occupational exposure limits</u>

Section 8. Exposure controls/personal protection

Ingredient name	Exposure limits
Methane, dichlorodifluoro-	Exposure limits ACGIH TLV (United States, 3/2012). TWA: 4950 mg/m³ 8 hours. TWA: 1000 ppm 8 hours. NIOSH REL (United States, 1/2013). TWA: 4950 mg/m³ 10 hours. TWA: 1000 ppm 10 hours. OSHA PEL (United States, 6/2010). TWA: 4950 mg/m³ 8 hours. TWA: 1000 ppm 8 hours. OSHA PEL (United States, 6/2010). TWA: 1000 ppm 8 hours. OSHA PEL 1989 (United States, 3/1989).
	TWA: 4950 mg/m ³ 8 hours. TWA: 1000 ppm 8 hours.

- Appropriate engineering
controls: Good general ventilation should be sufficient to control worker exposure to airborne
contaminants.
- **Environmental exposure controls** : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures	Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.
Skin protection	
Hand protection	Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. If contact with the liquid is possible, insulated gloves suitable for low temperatures should be worn. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

<u>Appearance</u>		
Physical state	:	Gas. [Liquefied gas]
Color	;	Colorless.
Molecular weight	;	120.91 g/mole
Molecular formula	;	C-Cl2-F2
Boiling/condensation point	;	-29.8°C (-21.6°F)
Melting/freezing point	;	-158°C (-252.4°F)
Critical temperature	;	111.85°C (233.3°F)
Odor	:	Characteristic.
Odor threshold	:	Not available.
рН	:	Not available.
Flash point	:	[Product does not sustain combustion.]
Burning time	:	Not applicable.
Burning rate	:	Not applicable.
Evaporation rate	:	Not available.
Flammability (solid, gas)	:	Not available.
Lower and upper explosive (flammable) limits	:	Not available.
Vapor pressure	:	84.9 (psia)
Vapor density	:	4.2 (Air = 1)
Specific Volume (ft ³ /lb)	:	3.1746
Gas Density (lb/ft ³)	:	0.315
Relative density	:	Not applicable.
Solubility	:	Not available.
Solubility in water	:	0.3 g/l
Partition coefficient: n- octanol/water	:	2.16
Auto-ignition temperature	:	Not available.
Decomposition temperature	:	Not available.
SADT	:	Not available.
Viscosity	;	Not applicable.

Section 10. Stability and reactivity

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Hazardous decomposition products	: Under norm not be prod	al conditions of storage a uced.	and use, hazardous	decomposition	products	should
Conditions to avoid	: No specific	data.				
Possibility of hazardous reactions	: Under norm	al conditions of storage	and use, hazardous	reactions will n	ot occur.	
Chemical stability	: The produc	t is stable.				
Reactivity	: No specific	test data related to react	ivity available for this	product or its	ingredient	.S.

Section 10. Stability and reactivity

: Under normal conditions of storage and use, hazardous polymerization will not occur. Hazardous polymerization

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely : Not available. routes of exposure

Potential acute health effects

Eye contact	:	Liquid can cause burns similar to frostbite.
Inhalation	:	Exposure to decomposition products may cause a health hazard. Serious effects may be delayed following exposure.
Skin contact	:	Dermal contact with rapidly evaporating liquid could result in freezing of the tissues or frostbite.
Ingestion	:	Ingestion of liquid can cause burns similar to frostbite.

Symptoms related to the physical, chemical and toxicological characteristics Eve contact : Adverse symptoms may include the following:

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Skin contact	: Adverse symptoms may include the frostbite	following:						
Inhalation	: No specific data.	: No specific data.						
	frostbite	.ee						

Date of previous issue

Section 11. Toxicological information

In	g	e	s	ti	0	n
	-		_			

: Adverse symptoms may include the following: frostbite

Delayed and immediate effect	ts	and also chronic effects from short and long term exposure
<u>Short term exposure</u>		
Potential immediate effects	:	Not available.
Potential delayed effects	:	Not available.
Long term exposure		
Potential immediate effects	:	Not available.
Potential delayed effects	:	Not available.
Potential chronic health effe	<u>ect</u>	<u>s</u>
Not available.		
General	:	No known significant effects or critical hazards.
Carcinogenicity	:	No known significant effects or critical hazards.
Mutagenicity	:	No known significant effects or critical hazards.
Teratogenicity	:	No known significant effects or critical hazards.
Developmental effects	:	No known significant effects or critical hazards.
Fertility effects	:	No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogPow	BCF	Potential
Methane, dichlorodifluoro-	2.16	6.17	low

Mobility in soil

Soil/water partition coefficient (Koc)

: Not available.

Other adverse effects

: No known significant effects or critical hazards.

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Section 13. Disposal considerations

Disposal methods

: The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Dichlorodifluoromethane; Methane, dichlorodifluoro-	75-71-8	Listed	U075

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	ΙΑΤΑ
UN number	UN1028	UN1028	UN1028	UN1028	UN1028
UN proper shipping name	DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12	DICHLORODIFLUOROMETHANE; OR REFRIGERANT GAS R 12	DICHLORODIFLUOROMETHANE OR REFRIGERANT GAS R 12	DICHLORODIFLUOROMETHANE (REFRIGERANT GAS R 12)	DICHLORODIFLUOROMETHANE
Transport hazard class(es)	2.2	2.2	2.2	2.2	2.2
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	Reportable quantity5000 lbs / 2270 kgPackage sizes shippedin quantities less thanthe product reportablequantity are not subjectto the RQ (reportablequantity) transportationrequirements.Limited quantityYes.Packaging instructionPassenger aircraftQuantity limitation: 75 kgCargo aircraftQuantity limitation: 150 kgSpecial provisionsT50	Explosive Limit and Limited Quantity Index 0.125 Passenger Carrying Road or Rail Index 75		-	Passenger and Cargo Aircraft Uuantity limitation: 75 kg Cargo Aircraft Only Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

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Section 14. Transport information

Special precautions for user	1	Transport within user's premises: always transport in closed containers that are
		upright and secure. Ensure that persons transporting the product know what to do in the
		event of an accident or spillage.

Transport in bulk according : Not available. to Annex II of MARPOL

73/78 and the IBC Code

S. Federal regulations.	:	TSCA 8(a) CE TSCA 12(b) a United States	DR Exempt/ Innual expo inventory	/Partia ort no (TSC	al exemption tification: dic A 8b): This m	: Not hloroo nateria	determin difluorom al is listeo	ed lethane l or exem	pted.	
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	:	Not listed								
Clean Air Act Section 602 Class I Substances	:	Listed								
Clean Air Act Section 602 Class II Substances	:	Not listed								
DEA List I Chemicals (Precursor Chemicals)	:	Not listed								
DEA List II Chemicals (Essential Chemicals)	:	Not listed								
SARA 302/304										
Composition/information of	on	ingredients								
No products were found.										
SARA 304 RQ		Not applicable) .							
SARA 311/312										
Classification	:	Sudden releas	se of pressu	ire						
Composition/information of	<u>on</u>	ingredients								
Name		%	Fir haz	e zard	Sudden release of pressure	Rea	ctive	Immed (acute) health hazard	iate	Delayed (chronic) health hazard
Methane, dichlorodifluoro-		100	No.		Yes.	No.		No.		No.
SARA 313								1		<u>.</u>
	F	Product name					CAS nu	mber	%	
Form R - Reporting requirements	Ċ	ichlorodifluoror	methane				75-71-8		100	
Supplier petification	c	ichlorodifluoror	methane				75-71-8		100	

SARA 313 notifications must not be detached from the SDS and any copying and redistribution of the SDS shall include copying and redistribution of the notice attached to copies of the SDS subsequently redistributed.

State regulations

Massachusetts	: This material is listed.			
New York	: This material is listed.			
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Section 15. Regulatory information

-		-
New Jersey	:	This material is listed.
Pennsylvania	:	This material is listed.
Canada inventory	:	This material is listed or exempted.
International regulations		
International lists	:	Australia inventory (AICS): This material is listed or exempted. China inventory (IECSC): This material is listed or exempted. Japan inventory: This material is listed or exempted. Korea inventory: This material is listed or exempted. Malaysia Inventory (EHS Register): Not determined. New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted. Philippines inventory (PICCS): This material is listed or exempted. Taiwan inventory (CSNN): Not determined.
Chemical Weapons Convention List Schedule I Chemicals	:	Not listed
Chemical Weapons Convention List Schedule II Chemicals	:	Not listed
Chemical Weapons Convention List Schedule III Chemicals	:	Not listed
<u>Canada</u>		
WHMIS (Canada)	:	Class A: Compressed gas.
		CEPA Toxic substances: This material is listed. Canadian ARET: This material is not listed. Canadian NPRI: This material is listed. Alberta Designated Substances: This material is not listed. Ontario Designated Substances: This material is not listed. Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



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Section 16. Other information

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Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

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Key to abbreviations	 ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = International Air Transport Association IBC = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA) CFR – United States Code of Federal Regulations CPR – Controlled Products Regulations CPR – Controlled Products Regulations DSL – Domestic Substances List GWP – Global Warming Potential IARC – International Agency for Research on Cancer ICAO – International Civil Aviation Organisation Inh – Inhalation LC – Lethal concentration LD – Lethal dosage MDSL – Non-Domestic Substances List NIOSH – National Institute for Occupational Safety and Health TDG – Canadian Transportation of Dangerous Goods Act and Regulations TLV – Threshold Limit Value TSCA – Toxic Substances Control Act WEEL – Workplace Environmental Exposure Level WHMIS – Canadian Workplace Hazardous Material Information System
References	: Not available.
Indicates information th	at has changed from previously issued version.
Other special	: WARNING: Contains (Dichlorodifluoromethane), a substance which harms the public
considerations	health and environment by destroying ozone in the upper atmosphere.
Notice to reader	

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Section 16. Other information

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

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MSDS SUMMARY SHEET

Manufacturer: Name: PHILLIPS PETROLEUM COMPANY Address 1: Address 2: Address 3: CSZ: BARTLESVILLE State: OK Zipcode: 74004 Emergency phone: (800) 424-9300 Business phone: 800-762-0942

Product:

Ferndale MSDS#: 1354 Version #: 6 Manufacturer MSDS#: 0041 Current?: 2002 Name:

NO. 2 DIESEL FUEL

Synonyms:

CARB Diesel TF3 CARB Diesel CARB **Diesel** 10% **Diesel** Fuel Oil EPA Low Sulfur **Diesel** Fuel EPA Low Sulfur Diesel Fuel – Dyed EPA Off Road High Sulfur Diesel - Dyed Fuel Oil No. 2 – CAS # 68476-30-2 No. 2 Diesel Fuel Oil No. 2 Fuel Oil – Non Hiway – Dyed No. 2 High Sulfur **Diesel** – Dyed No. 2 Low Sulfur Diesel - Dyed No. 2 Low Sulfur **Diesel** - Undyed Crude column 3rd IR Crude column 3^{rd} side cut Atmospheric tower 3rd side cut Ultra Low Sulfur Diesel No. 2 Finished **Diesel** DHT Reactor Feed Straight Run Diesel Diesel Middle Distillate **Product/Catalog Numbers:**

MSDS Date: 01/01/2002 (received: 01/14/2002)

NFPA codes: Health: 0 Flammability: 2 Reactivity: 0

No. 2 Diesel Fuel (MSDS #0041)

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MATERIAL SAFETY DATA SHEET No. 2 Diesel Fuel

1. PRODUCT AND COMPANY IDENTIFICATION

Product Name:	No. 2 Diesel Fuel	
Product Code:	Multiple	
SAP Code:		
Synonyms:	1354	
	CARB Diesel TF3	
	CARB Diesel	
	CARB Diesel 10%	
	Diesel Fuel Oil	
	EPA Low Sulfur Diesel Fuel	
	EPA Low Sulfur Diesel Fuel – Dyed	
	EPA Off Road High Sulfur Diesel – Dyed	
	Fuel Oil No. 2 – CAS # 68476-30-2	
	No. 2 Diesel Fuel Oil	
	No. 2 Fuel Oil – Non Hiway – Dyed	
	No. 2 High Sulfur Diesel – Dyed	
	No. 2 Low Sulfur Diesel - Dyed	
	No. 2 Low Sulfur Diesel – Undyed	
	No. 2 Ultra Low Sulfur Diesel – Dyed	
	No. 2 Ultra Low Sulfur Diesel - Undyed	
Intended Use:	Fuel	
Chemical Family:		
Responsible Party:	Phillip's Petroleum Company	
	Bartlesville, Oklahoma 74004	
For Additional MSDSs.	800-762-0942	

For Additional MSDSs: 800-762-0942 Technical Information:

The intended use of this product is indicated above. If any additional use is known, please contact us at the Technical Information number listed.

EMERGENCY OVERVIEW

24 Hour Emergency Telephone Numbers:

Spill, Leak, Fire or Accident Call CHEMTREC North America: (800) 424-9300 Others: (703) 527-3887 (collect) California Poison Control System: 800-356-3120

Health Hazards/Precautionary Measures: Causes severe skin irritation. Aspiration hazard if swallowed. Can enter lungs and cause damage. Use with adequate ventilation. Avoid contact with eyes, skin and clothing. Do not taste or swallow. Wash thoroughly after handling.

Physical Hazards/Precautionary Measures: Flammable liquid and vapor. Keep away from heat, sparks, flames, static electricity or other sources of ignition.

Appearance:	Straw-colored to dyed red
Physical Form:	Liquid
Odor:	Characteristic petroleum

HFPA Hazard Class:

Health:0 (Least)Flammability:2 (Moderate)Reactivity:0 (Least)

HMIS Hazard Class Not Evaluated

2. COMPOSITION/INFORMATION ON INGREDIENTS

HAZARDOUS COMPONENTS	<u>% VOLUME</u>		EXPOSURE GUIDELINE	
Diesel Fuel No. 2 CAS# 68476-34-6	100	<u>Limits</u> 100* mg/m3	<u>Agency</u> ACGIH	<u>Type</u> TWA-SKIN
Naphthalene CAS# 91-20-3	<1	10ppm 15ppm 10ppm 250ppm	ACGIH ACGIH OSHA NIOSH	TWA STEL TWA IDLH

All components are listed on the TSCA inventory

Tosco Low Sulfur No. 2 Diesel meets the specifications of 40 CFR 60.41 for low sulfur diesel fuel.

Note: State, local or other agencies or advisory groups may have established more stringent limits. Consult an industrial hygienist or similar professional, or your local agencies, for further information.

*Proposed ACGIH (1999)

3. HAZARDS IDENTIFICATION

Potential Health Effects:

Eye: Contact may cause mild eye irritation including stinging, watering, and redness.

Skin: Severe skin irritant. Contact may cause redness, itching, burning, and severe skin damage. Prolonged or repeated contact can worsen irritation by causing drying and cracking of the skin, leading to dermatitis (inflammation). Not actually toxic by skin absorption, but prolonged or repeated skin contact may be harmful (see Section 11).

Inhalation (Breathing): No information available. Studies by other exposure routes suggest a low degree of toxicity by inhalation.

Ingestion (Swallowing): Low degree of toxicity by ingestion. ASPIRATION HAZARD – This material can enter lungs during swallowing or vomiting and cause lung inflammation and damage.

Signs and Symptoms: Effects of overexposure may include irritation of the nose and throat, irritation of the digestive tract, nausea, diarrhea and transient excitation followed by signs of nervous system depression (e.g., headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue).

Cancer: Possible skin cancer hazard (see Sections 11 and 14).

Target Organs: There is limited evidence from animal studies that overexposure may cause injury to the kidney (see Section 11).

Developmental: Inadequate data available for this material.

Pre-Existing Medical Conditions: Conditions aggravated by exposure may include skin disorders and kidney disorders.

4. FIRST AID MEASURES

- **Eye:** If irritation or redness develops, move victim away from exposure and into fresh air. Flush eyes with clean water. If symptoms persist, seek medical attention.
- **Skin:** Immediately remove contaminated shoes, clothing, and constrictive jewelry and flush affected area(s) with large amounts of water. If skin surface is damaged, apply a clean dressing and seek immediate medical attention. If skin surface is not damaged, cleanse affected area(s) thoroughly by washing with mild soap and water. If irritation or redness develops, seek immediate medical attention.
- **Inhalation (Breathing):** If respiratory symptoms develop, move victim away from source of exposure and into fresh air. If symptoms persist, seek medical attention. If victim is not breathing, clear airway and immediately begin artificial respiration. If breathing difficulties develop, oxygen should be administered by qualified personnel. Seek immediate medical attention.
- **Ingestion (Swallowing):** Aspiration hazard; Do not induce vomiting or give anything by mouth because this material can enter the lungs and cause severe lung damage. If victim is drowsy or unconscious and vomiting, place on the left side with the head down. If possible, do not leave victim unattended and observe closely for adequacy of breathing. Seek medical attention.

5. FIRE FIGHTING MEASURES

Flammable Properties:	Flash Point: >125°F/>52° OSHA Flammability Class: Combustible liquid LEL %: 0.3 / UEL %: 10.0
	Autoignition Temperature: 500°F/260°C

- **Unusual Fire & Explosion Hazards:** This material is flammable and can be ignited by heat, sparks, flames, or other sources of ignition (e.g., static electricity, pilot lights, or mechanical/electrical equipment, and electronic devices such as cell phones, computers, calculators, and pagers which have not been certified as intrinsically safe). Vapors may travel considerable distances to a source of ignition where they can ignite, flash back, or explode. May create vapor/air explosion hazard indoors, in confined spaces, outdoors, or in sewers. Vapors are heavier than air and can accumulate in low areas. If container is not properly cooled, it can rupture in the heat of a fire.
- **Extinguishing Media:** Dry chemical, carbon dioxide, or foam is recommended. Water spray is recommended to cool or protect exposed materials or structures. Carbon dioxide can displace oxygen. Use caution when applying carbon dioxide in confined spaces. Water may be ineffective for extinguishment, unless used under favorable conditions by experienced fire fighters.
- **Fire Fighting Instructions:** For fires beyond the incipient stage, emergency responders in the immediate hazard area should wear bunker gear. When the potential chemical hazard is unknown, in enclosed or confined spaces, or when explicitly required by DOT, a self contained breathing apparatus should be worn. In addition, wear other appropriate protective equipment as conditions warrant (see Section 8).

Isolate immediate hazard area, keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Move undamaged containers from immediate hazard area if it can be done with minimal risk.

Water spray may be useful in minimizing or dispersing vapors and to protect personnel. Cool equipment exposed to fire with water, if it can be done with minimal risk. Avoid spreading burning liquid with water used for cooling purposes.

No. 2 Diesel Fuel (MSDS #0041)

6. ACCIDENTAL RELEASE MEASURES

Flammable. Keep all sources of ignition and hot metal surfaces away from spill/release. The use of explosion-proof equipment is recommended.

Stay upwind and away from spill/release. Notify persons down wind of the spill/release, isolate immediate hazard area and keep unauthorized personnel out. Stop spill/release if it can be done with minimal risk. Wear appropriate protective equipment including respiratory protection as conditions warrant (see Section 8).

Prevent spilled material from entering sewers, storm drains, other unauthorized drainage systems, and natural waterways. Dike far ahead of spill for later recovery or disposal. Use foam on spills to minimize vapors (see Section 5). Spilled material may be absorbed into an appropriate material.

Notify fire authorities and appropriate federal, state, and local agencies. Immediate cleanup of any spill is recommended. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, notify the National Response Center (phone number 800-424-8802).

7. HANDLING AND STORAGE

Handling: Open container slowly to relieve any pressure. Bond and ground all equipment when transferring from one vessel to another. Can accumulate static charge by flow or agitation. Can be ignited by static discharged. The use of explosion-proof equipment is recommended and may be required (see appropriate fire codes). Refer to NFPA-704 and/or API RP 2003 for specific bonding/grounding requirements.

Do not enter confined spaces such as tanks or pits without following proper entry procedures such ASTM D-4276 and 29CFR 1910.146. The use of appropriate respiratory protection is advised when concentrations exceed any established exposure limits (see Sections 2 and 8).

Do not wear contaminated clothing or shoes. Keep contaminated clothing away from sources of ignition such as sparks or open flames. Use good personal hygiene practices.

High pressure injection of hydrocarbon fuels, hydraulic oils or greases under the skin may have serious consequences even though no symptoms or injury may be apparent. This can happen accidentally when using high pressure equipment such as high pressure grease guns, fuel injection apparatus or from pinhole leaks in tubing or high pressure hydraulic oil equipment.

"Empty" containers retain residue and may be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, or other sources of ignition. They may explode and cause injury or death. "Empty" drums should be completely drained, properly bunged, and promptly shipped to the supplier or a drum reconditioner. All containers should be disposed of in an environmentally safe manner and in accordance with governmental regulations.

Before working on or in tanks which contain or have contained this material, refer to OSHA regulations, ANSIZ49.1 and other references pertaining to cleaning, repairing, welding, or other contemplated operations.

Storage: Keep container(s) tightly closed. Use and store this material in cool, dry, well-ventilated areas away from heat, direct sunlight, hot metal surfaces, and all sources of ignition. Post area "No Smoking or Open Flame." Store only in approved containers. Keep away from incompatible material (see Section 10). Protect container(s) against physical damage. Outdoor or detached storage is preferred. Indoor storage should meet OSHA standards and appropriate fire codes.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Engineering controls: If current ventilation practices are not adequate to maintain airborne concentration below the established exposure limits (see Section 2), additional ventilation or exhaust systems may be required. Where explosive mixtures may be present, electrical systems safe for such locations must be used (see appropriate electrical codes).

Personal Protective Equipment (PPE):

Respiratory: A NIOSH certified air purifying respirator with an organic vapor cartridge maybe used under conditions where airborne concentrations are expected to exceed exposure limits (see Section 2).

Protection provided by air purifying respirators is limited (see manufacturer's respirator selection guide). Use a positive pressure air supplied respirator if there is a potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air purifying respirators may not provide adequate protection.

A respiratory protection program that meets OSHA's 29 CFR 1910.134 and ANSI Z88.2 requirements must be followed whenever workplace conditions warrants a respirator's use.

- **Skin:** The use of gloves impervious to the specific material handled is advised to prevent skin contact, possible irritation and skin damage (see glove manufacturer literature for information on permeability). Depending on conditions of use, apron and/or arm covers may be necessary.
- **Eyes/Face:** Approved eye protection to safeguard against potential eye contact, irritation, or injury is recommended. Depending on conditions of use, a face shield may be necessary.
- **Other Protective Equipment:** Eye wash and quick-drench shower facilities should be available in the work area. Thoroughly clean shoes and wash contaminated clothing before reuse. It is recommended that impervious clothing be worn when skin contact is possible.

9. PHYSICAL AND CHEMICAL PROPERTIES

Note: Unless otherwise stated, values are determined at 20°C (68°F) and 760 mm Hg (1atm).

Appearance: Straw-colored to dyed red Physical State: Liquid Odor: Characteristic petroleum pH: unavailable Vapor Pressure (mm Hg): 0.40 Vapor Densisty (air=1):>3 Boiling Point/Range: 320-700°F /160-371°C Freezing/Melting Point: No Data Solubility in Water: Negligible Specific Gravity: 0.81-0.88 @ 60°F Percent Volatile: Negligible Evaporation Rate (nBuAc=1): <1 Viscosity: 32.6-40.0 SUS @ 100°F Bulk Density: 7.08 lbs/gal Flash Point: >125°F / >52°C Flammable/Expolsive Limits (%): LEL: 0.3 / UEL: 10.0

10. STABILITY AND REACTIVITY

Stability: Stable under normal ambient and anticipated storage and handling conditions of temperature and pressure. Flammable liquid and vapor. Vapor can cause flash fire.

Conditions To Avoid: Avoid all possible sources of ignition (see Sections 5 and 7).

Materials to Avoid (Incompatible Materials): Avoid contact with strong oxidants such as liquid chlorine, concentrated oxygen, sodium hypochlorite, calcium hypochlorite, etc.

No. 2 Diesel Fuel (MSDS #0041)

Hazardous Decomposition Products: The use of hydrocarbon fuels in an area without adequate ventilation may result in hazardous levels of combustion products (e.g., oxides of carbon, sulfur and nitrogen, benzene and other hydrocarbons) and/or dangerously low oxygen levels. ACGIH has included a TLV of 0.05 mg/m3 TWA for diesel exhaust particulate on its 1999 Notice of Intended Changes. See Section 11 for additional information on hazards of engine exhaust.

Hazardous Polymerization: Will not occur.

11. TOXICOLOGICAL INFORMATION

Diesel Fuel No. 2 (CAS# 68476-34-6)

Carcinogenicity: Chronic dermal application of certain middle distillate streams contained in diesel fuel No. 2 resulted in an increased incidence of skin tumors in mice. This material has not been identified as carcinogen by NTP, IARC, or OSHA. Diesel exhaust is a probable cancer hazard based on tests with laboratory animals.

Target Organ(s): Limited evidence of renal impairment has been noted from a few case reports involving excessive exposure to diesel fuel No. 2.

Naphthalene (CAS# 91-20-3)

Carcinogenicity: Naphthalene has been evaluated in two year inhalation studies in both rats and mice. The National Toxicology Program (NTP) concluded that there is clear evidence of carcinogenicity in male and female rats based on increased incidences of respiratory epithelial adenomas and olfactory epithelial neuroblastomas of the nose. NTP found some evidence of carcinogenicity in female mice (alveolar adenomas) and no evidence of carcinogenicity in male mice. Naphthalene has not been identified as a carcinogen by IARC or OSHA.

12. ECOLOGICAL INFORMATION

Not evaluated at this time

13. DISPOSAL CONSIDERATIONS

This material, if discarded as produced, would be a RCRA "characteristic" hazardous waste due to the characteristic(s) of ignitability (D001) and benzene (D018). If the material is spilled to soil or water, characteristic testing of the contaminated materials is recommended. Further, this material, once it becomes a waste, is subject to the land disposal restrictions in 40 CFR 268.40 and may require treatment prior to disposal to meet specific standards. Consult state and local regulations to determine whether they are more stringent then the federal requirements.

Container contents should be completely used and containers should be emptied prior to discard. Container ?<u>insate</u>? could be considered a RCRA hazardous waste and must be disposed of with care and in compliance with federal, state and local regulations. Large empty containers, such as drums, should be returned to the distributor or to a drum reconditioner. To assure proper disposal of smaller containers, consult with state and local regulations and disposal authorities.

14. TRANSPORT INFORMATION

DOT Shipping Description:	Diesel Fuel, NA1983
Non-Bulk Package Marking:	Diesel Fuel, 3, NA 1993, III

15. REGULATORY INFORMATION

EPA SARA 311/312 (Title III Hazard Categories):

Acute Health: Yes Chronic Health: Yes Fire Hazard: Yes Pressure Hazard: No Reactive Hazard: No

SARA 313 and 40 CFR 372:

This material contains the following chemicals subject to the reporting requirements of SARA 313 and 40 CFR 372:

CAS Number	Weight %
	CAS Number

-- None known --

California Proposition 65:

Warning: This material contains the following chemicals which are known to the state of California to cause cancer, birth defects or other reproductive harm, and are subject to the requirements of California Proposition 65 (CA Health & Safety Code Section 25249.5):

Component	Effect
Benzene	Cancer, Developmental and Reproductive Toxicant
Toluene	Developmental Toxicant
Diesel engine exhaust, while not a component of this material, the State of California to cause cancer.	is on the Proposition 65 list of chemicals known to

Carcinogen Identification:

This material has not been identified as a carcinogen by NTP, IARC, or OSHA. See Section 11 for carcinogenicity information of individual components, if any. Diesel exhaust is a probable cancer hazard based on tests in laboratory animals. It has been identified as carcinogen by IARC.

EPA (CERCLA Reportable Quantity: None

16. OTHER INFORMATION

Issue Date: 01/01/02 Previous Issue Date: 05/15/01 **Product Code: Multiple Revised Sections: None Previous Product Code: Multiple** MSDS Number: 0041

Disclaimer of Expressed and Implied Warranties:

The information presented in this Material Data Safety Sheet is based on data believed to be accurate as of the date this Material Data Sheet was prepared. HOWEVER, NO WARRANTY OF MERCHANTABILITY, FITNESS FOR ANY PARTICULAR PURPOSE, OR ANY OTHER WARRANTY IS EXPRESSED OR IS TO BE IMPLIED REGARDING THE ACCURACY OR COMPLETENESS OF THE INFORMATION PROVIDED ABOVE, THE RESULTS TO BE OBTAINED FROM THE USE OF THIS INFORMATION OR THE PRODUCT, THE SAFETY OF THE PRODUCT, OR THE HAZARDS RELATED TO ITS USE. No responsibility is assumed for any damage or injury resulting from abnormal use or from any failure to adhere to recommended practices. The information provided above, and the product, are furnished on the condition that the person receiving them shall make their own determination as to the suitability of the product for their particular purpose and on the condition that they assume the risk of their use. In addition, no authorization is given nor implied to practice any patented invention without a license.
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Tosco Refining Company

Ferndale Refinery

UltraLow Sulfur Diesel Product Specification

Ferndale Product Code:34380xx (5) Product Code: ULSD2

(COMETS)

Specification	Unit	Limit	Test Procedure	Typical
Appearance				
Water & Sediment	Vol %	0.05 Max	D 2709	
Color	Number	3.0 Max	D 1500	
Haze Rating	Rating	2 Max	D 4176	
Composition				
Carbon Residue (Ramsbottom)	Wt %	0.35 Max	D 524, D 189	
Volatility				
90% Recovered	Deg; F	540 Min	D 86	
	Deg; F	640 Min	D 86	
Flash Point	Deg; F	125 Min (1)	D 93	130 F
Gravity	API	30 Min	D 287, D4052	
			,	
Fluidity				
Pour Point	Deg; F	See Season Table (6)	D 97	
Cloud Point	Deg; F	See Season Table (6)	D 2500	10 F
Viscosity @ 104F	cSt	1.9 Min	D 445	
	cSt	4.1 Max	D 445	
Lubricity, SLBOCLE	grams	3100 Min	D 6078	3300gm
				-
Lubricity, HFRR	mm	.45	D 6079	
Combustion				
Cetane Index or Cetane Number	Number	40.0 Min	D 976, D613	47.0
(3,4)				
Corrosion				
Copper Strip, 3hr @ 50 deg C	Number	3 Max (2)	D 130	
Aromatics (4)	Vol %	35 Max	D 1319	25 %
Contaminants				
Total Sulfur	PPM	30 Max	D 2622, D4294	15-20ppm
Water & Sediment	Vol %	0.05 Max	D 1796	
Ash	Wt %	0.01 Max	D 482	
Additives				
Cetane Improver	Lb/MBb1	675 Max		
Dye		Undyed		

1. Minimum release specification is 125 deg. F. The refinery should target 135 deg. F.

2. Test result reported as a number and letter (e.g. 1a). Any letter is allowable as long as the number meets the spec shown.

3. Either specification must be met.

4. Either cetane index minimum or aromatics maximum must be met.

5. Winter cloud and pour specifications may be relaxed to the summer specifications by agreement with the customer.

6. Season Table

Month	Product Code	Pour Point Cloud Point	
Jan, Feb, Nov, Dec	WI	0 max (5)	14 max (5)
Mar - Oct	SU	15 max	24 max

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.10 Revision Date 07/09/2015 Print Date 02/23/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Ethyl Alcohol, pure
	Product Number Brand Index-No.	:	459836 Sigma-Aldrich 603-002-00-5
	CAS-No.	:	64-17-5
1.2	Relevant identified uses of	i th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Manufacture of substances
1.3	Details of the supplier of the	ne s	safety data sheet
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052
1.4	Emergency telephone num	ıbe	r

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS) Flammable liquids (Category 2), H225 Eye irritation (Category 2A), H319

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s) H225 H319	Highly flammable liquid and vapour. Causes serious eye irritation.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P264	Wash skin thoroughly after handling.
P280	Wear protective gloves/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing.

	Rinse skin with water/shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to extinguish.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms:Absolute alcoholFormula:C2H6OMolecular weight:46.07 g/molCAS-No.:64-17-5EC-No.:200-578-6Index-No.:603-002-00-5

Hazardous components

Component	Classification	Concentration
Ethanol		
	Flam. Liq. 2; Eye Irrit. 2A;	<= 100 %
	H225, H319	
For the full text of the U Statemer	ate montioned in this Section, and Section 16	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Hygroscopic. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

	•	•		
Component	CAS-No.	Value	Control parameters	Basis
Ethanol	64-17-5	TWA	1,000.000000	USA. ACGIH Threshold Limit Values
			ppm	(TLV)
	Remarks	Upper Respi	ratory Tract irritatio	n
		Confirmed an	nimal carcinogen w	vith unknown relevance to humans
		TWA	1,000 ppm	USA. OSHA - TABLE Z-1 Limits for
			1,900 mg/m3	Air Contaminants - 1910.1000
		TWA	1,000 ppm	USA. Occupational Exposure Limits
			1,900 mg/m3	(OSHA) - Table Z-1 Limits for Air
				Contaminants
		The value in	mg/m3 is approxin	nate.
		TWA	1,000.000000	USA. Occupational Exposure Limits
			ppm	(OSHA) - Table Z-1 Limits for Air
			1,900.000000	Contaminants
			mg/m3	
		The value in	mg/m3 is approxin	nate.

TWA	1,000.000000 ppm 1,900.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
STEL	1,000.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
Upper Respi Confirmed a	ratory Tract irritation	on vith unknown relevance to humans

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: butyl-rubber Minimum layer thickness: 0.3 mm Break through time: 480 min Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 38 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- a) Appearance Form: liquid, clear Colour: colourless
- b) Odour No data available

c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -114 °C (-173 °F)
f)	Initial boiling point and boiling range	78 °C (172 °F)
g)	Flash point	14.0 °C (57.2 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 19 %(V) Lower explosion limit: 3.3 %(V)
k)	Vapour pressure	59.5 hPa (44.6 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	0.789 g/mL at 25 °C (77 °F)
n)	Water solubility	completely soluble
o)	Partition coefficient: n- octanol/water	log Pow: -0.349 at 24 °C (75 °F)
p)	Auto-ignition temperature	363.0 °C (685.4 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
~		

9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5** Incompatible materials Alkali metals, Oxidizing agents, Peroxides
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity LD50 Oral - Rat - 10,470 mg/kg LC50 Inhalation - Rat - 4 h - 30,000 mg/l

LD50 Dermal - Rabbit - 15,800 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit Result: No skin irritation - 24 h (OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit Result: Moderate eye irritation (OECD Test Guideline 405)

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

Carcinogenicity - Mouse - Oral

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Liver:Tumors. Blood:Lymphomas including Hodgkin's disease.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Reproductive toxicity - Human - female - Oral Effects on Newborn: Apgar score (human only). Effects on Newborn: Other neonatal measures or effects. Effects on Newborn: Drug dependence.

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: KQ6300000

Central nervous system depression, narcosis, Damage to the heart., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fishLC50 - Pimephales promelas (fathead minnow) - 14,200 mg/l - 96 hToxicity to daphnia and
other aquatic
invertebratesLC50 - Ceriodaphnia dubia (water flea) - 5,012 mg/l - 48 h

NOEC - Daphnia magna (Water flea) - 9.6 mg/l - 9 d

Toxicity to algae EC50 - Chlorella vulgaris (Fresh water algae) - 275 mg/l - 72 h (OECD Test Guideline 201)

12.2 Persistence and degradability Biodegradability Result:

Result: 95 % - Readily biodegradable

12.3 Bioaccumulative potential

Due to the distribution coefficient n-octanol/water, accumulation in organisms is not expected.

12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1170 Class: 3 Proper shipping name: Ethanol Reportable Quantity (RQ):	Packing group: II	
Poison Inhalation Hazard: No		
IMDG UN number: 1170 Class: 3 Proper shipping name: ETHANOL	Packing group: II	EMS-No: F-E, S-D
IATA UN number: 1170 Class: 3 Proper shipping name: Ethanol	Packing group: II	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

Ethanol	CAS-No. 64-17-5	Revision Date 2007-03-01
Pennsylvania Right To Know Components	CAS-No.	Revision Date

Ethanol	64-17-5	2007-03-01	
New Jersey Right To Know Components	CAS-No.	Revision Date	
Ethanol	64-17-5	2007-03-01	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.

HMIS Rating

2
*
3
0
2
3

Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.10

Revision Date: 07/09/2015

Print Date: 02/23/2016



Material Name: ETHYL BENZENE

SDS ID: MAT08780

Section 1 - PRODUCT AND COMPANY IDENTIFICATION

Material Name ETHYL BENZENE **Synonyms** MTG MSDS 185; EB; PHENYLETHANE; ETHYLBENZENE; ETHYLBENZOL; ALPHA-METHYLTOLUENE; UN 1175; C8H10 **Chemical Family** Hydrocarbons, aromatic **Product Use** industrial. **Restrictions on Use** None known. Details of the supplier of the safety data sheet MATHESON TRI-GAS, INC. 150 Allen Road, Suite 302 Basking Ridge, NJ 07920 General Information: 1-800-416-2505 Emergency #: 1-800-424-9300 (CHEMTREC) Outside the US: 703-527-3887 (Call collect)

Section 2 - HAZARDS IDENTIFICATION

Classification in accordance with paragraph (d) of 29 CFR 1910.1200. Flammable Liquids - Category 2 Aspiration Hazard - Category 1 Acute Toxicity - Inhalation - Dust/Mist - Category 4 Acute Toxicity - Inhalation - Vapor - Category 4 Skin Corrosion/Irritation - Category 2 Serious Eye Damage/Eye Irritation - Category 2A Carcinogenicity - Category 2 Reproductive Toxicity - Category 1B Specific target organ toxicity - Single exposure - Category 2 Specific target organ toxicity - Single exposure - Category 3 Specific Target Organ Toxicity - Repeated Exposure - Category 2 (ears , Ears) Hazardous to the Aquatic Environment - Acute - Category 2 Hazardous to the Aquatic Environment - Chronic - Category 2 **GHS Label Elements** Symbol(s)



Page 1 of 11

Hazard Statement(s)



Material Name: ETHYL BENZENE

SDS ID: MAT08780

Highly flammable liquid and vapor.

- Harmful if inhaled.
- Causes skin irritation.
- Causes serious eye irritation.
- Suspected of causing cancer.
- May damage fertility or the unborn child.
- May cause damage to organs. (central nervous system)
- May cause respiratory irritation.
- May be fatal if swallowed and enters airways.
- Toxic to aquatic life.

Precautionary Statement(s)

Prevention

- Keep away from heat, sparks, open flame, and hot surfaces No smoking.
- Keep container tightly closed.
- Ground/Bond container and receiving equipment.
- Use explosion-proof electrical/ventilating/lighting equipment.
- Use only non-sparking tools.
- Take precautionary measures against static discharge.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use Personal Protective equipment as required.
- Do not breathe vapor or mist.
- Use only outdoors or in a well-ventilated area.
- Wear protective gloves and eye/face protection.
- Wash thoroughly after handling.
- Do not eat, drink or smoke when using this product.
- Avoid release to the environment.

Response

- In case of fire, use media appropriate for extinction.
- IF exposed or concerned: Get medical advice/attention.
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
- Call a POISON CENTER or doctor/physician if you feel unwell.
- IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower.
- If skin irritation occurs: Get medical advice/attention.
- Wash contaminated clothing before reuse.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
- If eye irritation persists: Get medical advice/attention.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
- Do NOT induce vomiting.

Storage

- Store in a well-ventilated place.
- Keep cool.
- Keep container tightly closed.
- Store locked up.

Disposal

Dispose in accordance with all applicable regulations.

Statement(s) of Unknown Acute Toxicity

Inhalation 0% of the mixture consists of ingredient(s) of unknown acute toxicity.



Material Name: ETHYL BENZENE

Statement(s) of Unknown Aquatic Toxicity

0% of the mixture consists of ingredient(s) of unknown acute aquatic toxicity. 0% of the mixture consists of ingredient(s) of unknown chronic aquatic toxicity.

Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS		
CAS Component Name		Percent
100-41-4	ETHYL BENZENE	100
Section 4 - FIRST AID MEASURES		

Inhalation

If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin

Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

Eyes

Flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Then get immediate medical attention.

Ingestion

aspiration hazard. Do NOT induce vomiting. When vomiting occurs, keep head lower than hips to help prevent aspiration. Get medical attention immediately. Give artificial respiration if not breathing.

Most Important Symptoms/Effects

Acute

respiratory tract irritation, skin irritation, eye irritation, central nervous system damage, lung damage (from aspiration)

Delayed

cancer, Reproductive Effects

Note to Physicians

For inhalation, consider oxygen.

Section 5 - FIRE FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media

regular dry chemical, carbon dioxide, water spray, regular foam, Large fires: Use water spray, fog or regular foam. **Unsuitable Extinguishing Media**

Do not use high-pressure water streams.

Special Hazards Arising from the Chemical

Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

Hazardous Combustion Products

Oxides of carbon

Fire Fighting Measures

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank,

SDS ID: MAT08780



Material Name: ETHYL BENZENE

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rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Water may be ineffective.

Special Protective Equipment and Precautions for Firefighters

Wear full protective fire fighting gear including self contained breathing apparatus (SCBA) for protection against possible exposure.

Section 6 - ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Wear personal protective clothing and equipment, see Section 8.

Methods and Materials for Containment and Cleaning Up

Avoid heat, flames, sparks and other sources of ignition. Eliminate all ignition sources if safe to do so. All equipment used when handling the product must be grounded. Do not touch or walk through spilled material. Stop leak if possible without personal risk. Prevent entry into waterways, sewers, basements, or confined areas. Reduce vapors with water spray. Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Dike for later disposal. Remove sources of ignition. Use water spray to reduce vapors or divert vapor cloud drift. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

Environmental Precautions

Avoid release to the environment.

Section 7 - HANDLING AND STORAGE

Precautions for Safe Handling

Keep away from heat, sparks, open flame, and hot surfaces - No smoking. Keep container tightly closed. Ground/bond container and receiving equipment. Use explosion-proof electrical/ventilating/lighting equipment. Use only non-sparking tools. Take precautionary measures against static discharges. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use Personal Protective equipment as required. Do not breathe vapor or mist. Use only outdoors or in a well-ventilated area. Wear protective gloves/eye protection/face protection. Wash hands thoroughly after handling. Do not eat, drink, or smoke when using this product. Avoid release to the environment.

Conditions for Safe Storage, Including any Incompatibilities

Store in a well-ventilated place.

Keep cool.

Keep container tightly closed.

Store locked up.

Store and handle in accordance with all current regulations and standards. Store in a well-ventilated area. Keep cool. Keep container tightly closed. Keep locked up. Grounding and bonding required. Keep separated from incompatible substances. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106.

Incompatible Materials

Acids, bases, oxidizing materials, combustible materials

Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION		
Component Exposure	e Limits	
ETHYL BENZENE	100-41-4	



Material Name: ETHYL BENZENE

 ACGIH:
 20 ppm TWA

 NIOSH:
 100 ppm TWA ; 435 mg/m3 TWA

 I25 ppm STEL ; 545 mg/m3 STEL
 125 ppm IDLH (10% LEL)

 Europe:
 100 ppm TWA ; 442 mg/m3 TWA

 I00 ppm TWA ; 442 mg/m3 TWA
 200 ppm STEL ; 884 mg/m3 STEL

 OSHA (US):
 100 ppm TWA ; 435 mg/m3 TWA

 Mexico:
 100 ppm TWA YLE-PPT ; 435 mg/m3 TWA VLE-PPT

 I25 ppm STEL [PPT-CT]; 545 mg/m3 STEL [PPT-CT]

ACGIH - Threshold Limit Values - Biological Exposure Indices (BEI) ETHYL BENZENE (100-41-4)

0.15 g/g creatinine Medium: urine Time: end of shift Parameter: Sum of mandelic acid and phenylglyoxylic acid (nonspecific)

Engineering Controls

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

Individual Protection Measures, such as Personal Protective Equipment

Eye/face protection

Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Skin Protection

Wear appropriate chemical resistant clothing.

Respiratory Protection

The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA. 800 ppm. Any air-purifying half-mask respirator equipped with organic vapor cartridge(s). Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any powered, air-purifying respirator with organic vapor cartridge(s). Any supplied-air respirator. Any self-contained breathing apparatus with a full facepiece. Emergency or planned entry into unknown concentrations or IDLH conditions -. Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode. Any supplied-air respirator with a full facepiece respirator (gas mask) with a chin-style, front-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode or back-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with a full facepiece that is operated in a pressure-demand or other positive-pressure mode. Escape -. Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister. Any appropriate escape-type, self-contained breathing apparatus. Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus operates in a pressure-demand or other positive-pressure mode. Any self-contained breathing apparatus that has a full fac

Glove Recommendations

Wear appropriate chemical resistant gloves.

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Material Name: ETHYL BENZENE

SDS ID: MAT08780

Section 9 - PHYSICAL AND CHEMICAL PROPERTIES			
Appearance	Clear, colorless liquid	Physical State	liquid
Odor	aromatic odor	Color	colorless
Odor Threshold	140 ppm	рН	Not available
Melting Point	-95 °C (-139 °F)	Boiling Point	136 °C (277 °F)
Boiling Point Range	Not available	Freezing point	Not available
Evaporation Rate	<1 (Butyl acetate = 1)	Flammability (solid, gas)	Not available
Autoignition Temperature	432 °C (810 °F)	Flash Point	15 °C Closed Cup (59 °F)
Lower Explosive Limit	0.8 %	Decomposition temperature	Not available
Upper Explosive Limit	6.7 %	Vapor Pressure	7.1 mmHg @ 20 °C
Vapor Density (air=1)	3.66	Specific Gravity (water=1)	0.867
Water Solubility	0.015 %	Partition coefficient: n- octanol/water	154170.05
Viscosity	0.64 cp	Kinematic viscosity	Not available
Solubility (Other)	Not available	Bioconcentration Factor (BCF)	36.39
Density	Not available	Henry's Law Constant	0.00788 atm-m3/mole
КОС	520 (Estimated)	Physical Form	liquid
Volatility	100 %	Molecular Formula	С-Н3-С-Н2-С6-Н5
Molecular Weight	106.17	OSHA Flammability Class	IB

Solvent Solubility

alcohol, ether, Benzene, sulfur dioxide, carbon tetrachloride Insoluble

ammonia

Section 10 - STABILITY AND REACTIVITY

Reactivity

No reactivity hazard is expected. Chemical Stability

Stable at normal temperatures and pressure.

Soluble



Material Name: ETHYL BENZENE

SDS ID: MAT08780

Possibility of Hazardous Reactions

Will not polymerize. Conditions to Avoid

Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

Incompatible Materials

Acids, bases, oxidizing materials, combustible materials

Hazardous decomposition products

Oxides of carbon

Section 11 - TOXICOLOGICAL INFORMATION

Information on Likely Routes of Exposure

Inhalation

irritation (possibly severe), chest pain, difficulty breathing, emotional disturbances, headache, drowsiness, dizziness, loss of coordination, coma, cancer

Skin Contact

irritation **Eye Contact**

irritation

Ingestion

nausea, vomiting, stomach pain, aspiration hazard

Acute and Chronic Toxicity

Component Analysis - LD50/LC50

The components of this material have been reviewed in various sources and the following selected endpoints are published:

ETHYL BENZENE (100-41-4)

Oral LD50 Rat 3500 mg/kg Dermal LD50 Rabbit 15400 mg/kg Inhalation LC50 Rat 17.4 mg/L 4 h **Product Toxicity Data**

Acute Toxicity Estimate

Dermal	> 2000 mg/kg
Inhalation - Vapor	17.4 mg/L
Oral	> 2000 mg/kg

Immediate Effects

respiratory tract irritation, skin irritation, eye irritation, central nervous system damage, lung damage (from aspiration) **Delayed Effects** Reproductive Effects, cancer **Irritation/Corrosivity Data** respiratory tract irritation, skin irritation, eye irritation **Respiratory Sensitization** No data available. **Dermal Sensitization** No data available. **Component Carcinogenicity**



Material Name: ETHYL BENZENE

ETHYL BENZENE	100-41-4	
ACGIH:	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans	
IARC:	Monograph 77 [2000] (Group 2B (possibly carcinogenic to humans))	
DFG:	Category 4 (no significant contribution to human cancer)	
OSHA:	Present	

Germ Cell Mutagenicity
No data available.
Tumorigenic Data
No data available
Reproductive Toxicity
Available data characterizes components of this product as reproductive hazards.
Specific Target Organ Toxicity - Single Exposure
central nervous system, Respiratory system
Specific Target Organ Toxicity - Repeated Exposure
No target organs identified.
Aspiration hazard
This material is an aspiration hazard.
Medical Conditions Aggravated by Exposure
kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies
Additional Data
May cross the placenta.

Section 12 - ECOLOGICAL INFORMATION

Ecotoxicity

Toxic to aquatic life. Component Analysis - Aquatic Toxicity

ETHYL BENZENE	100-41-4
Fish:	LC50 96 h Oncorhynchus mykiss 11 - 18 mg/L [static]; LC50 96 h Oncorhynchus mykiss 4.2 mg/L [semi-static]; LC50 96 h Pimephales promelas 7.55 - 11 mg/L [flow-through]; LC50 96 h Lepomis macrochirus 32 mg/L [static]; LC50 96 h Pimephales promelas 9.1 - 15.6 mg/L [static]; LC50 96 h Poecilia reticulata 9.6 mg/L [static]
Algae:	EC50 72 h Pseudokirchneriella subcapitata 4.6 mg/L IUCLID ; EC50 96 h Pseudokirchneriella subcapitata >438 mg/L IUCLID ; EC50 72 h Pseudokirchneriella subcapitata 2.6 - 11.3 mg/L [static] EPA ; EC50 96 h Pseudokirchneriella subcapitata 1.7 - 7.6 mg/L [static] EPA
Invertebrate:	EC50 48 h Daphnia magna 1.8 - 2.4 mg/L IUCLID

Persistence and Degradability

Not expected to undergo hydrolysis in the environment.

Bioaccumulative Potential

Bioconcentration potential in aquatic organisms is low based on a BCF value of 15. **Mobility**

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Material Name: ETHYL BENZENE

SDS ID: MAT08780

Expected to have moderate mobility in soil.

Section 13 - DISPOSAL CONSIDERATIONS

Disposal Methods

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

Component Waste Numbers

The U.S. EPA has not published waste numbers for this product's components.

Section 14 - TRANSPORT INFORMATION

US DOT Information: Shipping Name: ETHYLBENZENE Hazard Class: 3 UN/NA #: UN1175 Packing Group: II Required Label(s): 3 Marine pollutant

IMDG Information:

Shipping Name: ETHYLBENZENE Hazard Class: 3 UN#: UN1175 Packing Group: II Required Label(s): 3 Marine pollutant International Bulk Chemical Code This material contains one or more of the following chemicals required by the IBC Code to be identified as dangerous chemicals in bulk.

ETHYL BENZENE	100-41-4
IBC Code:	Category Y

Section 15 - REGULATORY INFORMATION

U.S. Federal Regulations

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), and/or require an OSHA process safety plan.

ETHYL BENZENE	100-41-4	
SARA 313:	0.1 % de minimis concentration	
CERCLA:	1000 lb final RQ ; 454 kg final RQ	

SARA Section 311/312 (40 CFR 370 Subparts B and C) reporting categories

Flammable; Carcinogenicity; Acute toxicity; Reproductive Toxicity; Skin Corrosion/Irritation; Serious Eye Damage/Eye Irritation; Specific Target Organ Toxicity; Aspiration Hazard

U.S. State Regulations

The following components appear on one or more of the following state hazardous substances lists:



Material Name: ETHYL BENZENE

ComponentCASCAMAMNNJPAETHYL BENZENE100-41-4YesYesYesYesYes

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer

ETHYL BENZENE	100-41-4
Carc:	carcinogen , 6/11/2004

Canada Regulations

Canadian WHMIS Ingredient Disclosure List (IDL)

Components of this material have been checked against the Canadian WHMIS Ingredients Disclosure List. The List is composed of chemicals which must be identified on MSDSs if they are included in products which meet WHMIS criteria specified in the Controlled Products Regulations and are present above the threshold limits listed on the IDL

ETHYL BENZENE	100-41-4
	0.1 %

WHMIS Classification

B2

Component Analysis - Inventory ETHYL BENZENE (100-41-4)

US	CA	EU	AU	РН	JP - ENCS	JP - ISHL	KR KECI - Annex 1	KR KECI - Annex 2	KR - REACH CCA	CN	NZ	MX	тw	VN - NCI (Draft)
Yes	DSL	EIN	Yes	Yes	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes

Section 16 - OTHER INFORMATION

NFPA Ratings

Health: 2 Fire: 3 Reactivity: 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Summary of Changes

Updated: 05/01/2015

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CA/MA/MN/NJ/PA - California/Massachusetts/Minnesota/New Jersey/Pennsylvania*; CAS - Chemical Abstracts Service; CERCLA -

Comprehensive Environmental Response, Compensation, and Liability Act; CFR - Code of Federal Regulations (US); CLP - Classification, Labelling, and Packaging; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSD - Dangerous Substance Directive; DSL - Domestic Substances List; EC – European Commission; EEC - European Economic Community; EIN - European Inventory of (Existing Commercial Chemical Substances); EINECS - European Inventory of Existing Commercial Chemical Substances; ENCS - Japan Existing and New Chemical Substance Inventory; EPA - Environmental Protection Agency; EU - European Union; F - Fahrenheit; IARC - International Agency for Research

SDS ID: MAT08780



Material Name: ETHYL BENZENE

SDS ID: MAT08780

on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL -Ingredient Disclosure List; IDLH - Immediately Dangerous to Life and Health; IMDG - International Maritime Dangerous Goods; ISHL - Japan Industrial Safety and Health Law; IUCLID - International Uniform Chemical Information Database; JP - Japan; Kow - Octanol/water partition coefficient; KR KECI Annex 1 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL); KR KECI Annex 2 - Korea Existing Chemicals Inventory (KECI) / Korea Existing Chemicals List (KECL), KR - Korea; LD50/LC50 - Lethal Dose/ Lethal Concentration; LEL - Lower Explosive Limit; LLV - Level Limit Value; LOLI - List Of LIstsTM -ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL -Maximum Exposure Limits; MX – Mexico; NDSL – Non-Domestic Substance List (Canada); NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PEL- Permissible Exposure Limit; PH - Philippines; RCRA - Resource Conservation and Recovery Act; REACH- Registration, Evaluation, Authorisation, and restriction of Chemicals; RID - European Rail Transport; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TCCA - Korea Toxic Chemicals Control Act; TDG - Transportation of Dangerous Goods; TLV - Threshold Limit Value; TSCA -Toxic Substances Control Act; TW - Taiwan; TWA - Time Weighted Average; UEL - Upper Explosive Limit; UN/NA - United Nations /North American; US - United States; VLE - Exposure Limit Value (Mexico); VN NCI (Draft) - Vietnam National Chemicals Inventory (NCI) (Draft); WHMIS - Workplace Hazardous Materials Information System (Canada).

Other Information

Disclaimer:

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MATERIAL SAFETY

DATA SHEET

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards **1. PRODUCT IDENTIFICATION**

CHEMICAL NAME; CLASS: NON-FLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas:Oxygen, 0.0015-23.5%;Methane, 0.0005-2.5%;Carbon Monoxide, 0.0005-1.0%; Hydrogen Sulfide, 0.001-0.025%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50018

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: SUPPLIER/MANUFACTURER'S NAME: ADDRESS: Calibration of Monitoring and Research Equipment CALGAZ 821 Chesapeake Drive Cambridge, MD 21613 CHEMTREC: 1-800-424-9300 1-410-228-6400 1-713/868-0440 1-800/231-1366

EMERGENCY PHONE: BUSINESS PHONE:

General MSDS Information Fax on Demand:

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACG	IH	0	SHA	NIOSH	OTHER
			TLV	STEL	PEL	STEL	IDLH	
			ppm	ppm	ppm	ppm	ppm	ppm
Oxygen	7782-44-7	0.0015 - 23.5%	There are	e no specif	ic exposure limits fo	or Oxygen. Oxygen le	evels should	be maintained above 19.5%.
Methane	74-82-8	0.0005 - 2.5%	There are	There are no specific exposure limits for Methane. Methane is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.				le asphyxiant (SA). Oxygen
Hydrogen Sulfide	7783-06-4	0.001- 0.025 %	10 (NIC = 5)	15	10 (Vacated 1989 PEL)	20 (ceiling); 50 (ceiling, 10 min. peak once per 8- hour shift 15 (vacated 1989 PEL)	100	NIOSH REL: STEL = 10 (ceiling) 10 minutes DFG-MAKs: TWA = 10 PEAK = 2•MAK, 10 min., momentary value
Carbon Monoxide	630-08-0	0.0005 - 1.0%	25	NE	50 35 (Vacated 1989 PEL)	200 [ceiling] (Vacated 1989 PEL)	1200	NIOSH RELS: TWA = 35 STEL = 200 (ceiling) DFG MAKs: TWA = 30 PEAK = 2•MAK, 15 min., average value DFG MAK Pregnancy Risk Classification: B
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

 NE = Not Established.
 NIC = Notice of Intended Change
 See Section 16 for Definitions of Terms Used.

 NOTE (1):
 ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This gas mixture is a colorless gas which has a rotten-egg odor (due to the presence of Hydrogen Sulfide). The odor cannot be relied on as an adequate warning of the presence of this gas mixture, because olfactory fatigue occurs after over-exposure to Hydrogen Sulfide. Hydrogen Sulfide and Carbon Monoxide (another component of this gas mixture) are toxic to humans in relatively low concentrations. Over-exposure to this gas mixture can cause skin or eye irritation, nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Additionally, releases of this gas mixture may produce oxygen-deficient atmospheres (especially in small confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant route of over-exposure for this gas mixture is by inhalation.

INHALATION: Due to the small size of an individual cylinder of this gas mixture, no unusual health effects from over-exposure to the product are anticipated under routine circumstances of use. A potential health hazard associated with this gas mixture is the potential of inhalation of Hydrogen Sulfide, a component of this gas mixture. Such over-exposures may occur if this gas mixture is used in a confined space or other poorly-ventilated area. Over-exposures to Hydrogen Sulfide can cause dizziness, headache, and nausea. Over-exposure to this gas could result in respiratory arrest, coma, or unconsciousness, due to the presence of Hydrogen Sulfide. Continuous inhalation of low concentrations of Hydrogen Sulfide may cause olfactory fatigue, so that the odor is no longer an effective warning of the presence of this gas. A summary of exposure concentrations and observed effects are as follows:

CONCENTRATION OF		PROTECTIVE EQUIPMENT
HYDROGEN SULFIDE	OBSERVED EFFECT	
0.3-30 ppm	Odor is unpleasant.	EYES RESPIRATORY HANDS BODY
50 ppm	Eye irritation. Dryness and irritation of nose, throat.	See Section 9
Slightly higher than 50 ppm	Irritation of the respiratory system.	See Section 8
100-150 ppm	Temporary loss of smell.	
200-250 ppm	Headache, vomiting nausea. Prolonged exposure may	For Routine Industrial Use and Handling Applications
	lead to lung damage. Exposures of 4-8 hours can be fatal.	
300-500	Swifter onset of symptoms. Death occurs in 1-4 hours.	
500 ppm	Headache, excitement, staggering, and stomach ache aft	ter brief exposure. Death occurs within 0.5 - 1
	hour of exposure.	
> 600 ppm	Rapid onset of unconsciousness, coma, death.	
> 1000 ppm	Immediate respiratory arrest.	
NOTE:	This gas mixture contains a maximum of 250 ppm Hydro	gen Sulfide. The higher concentration values

NOTE: This gas mixture contains a maximum of 250 ppm Hydrogen Sulfide. The higher concentration values here are presented to delineate the complete health effects which have been observed for humans after exposure to Hydrogen Sulfide.

HAZARDOUS MATERIAL IDENTIFICATION SYSTEM

FLAMMABILITY HAZARD (RED)

(BLUE)

(YELLOW)

3

0

0

HEALTH HAZARD

PHYSICAL HAZARD

3. HAZARD IDENTIFICATION (continued)

Inhalation over-exposures to atmospheres containing more than the Threshold Limit Value of Carbon Monoxide (25 ppm), another component of this gas mixture, can result in serious health consequences. Carbon Monoxide is classified as a chemical asphyxiant, producing a toxic action by combining with the hemoglobin of the blood and replacing the available oxygen. Through this replacement, the body is deprived of the required oxygen, and asphyxiation occurs. Since the affinity of Carbon Monoxide for hemoglobin is about 200-300 times that of oxygen, only a small amount of Carbon Monoxide will cause a toxic reaction to occur. Carbon Monoxide exposures in excess of 50 ppm will produce symptoms of poisoning if breathed for a sufficiently long time. If this gas mixture is released in a small, poorly ventilated area (i.e. an enclosed or confined space), symptoms which may develop include the following:

CONCENTRATION OF	
CARBON MONOXIDE	
All exposure levels:	

OBSERVED EFFECT

Over-exposure to Carbon Monoxide can be indicated by the lips and fingernails turning bright red. 200 ppm: Slight symptoms (i.e. headache) after several hours of exposure. 400 ppm: 1,000 -2000 ppm: Headache and discomfort experienced within 2-3 hours of exposure. Within 30 minutes, slight palpitations of the heart occurs. Within 1.5 hours, there is a tendency to stagger.

Within 2 hours, there is mental confusion, headaches, and nausea. Unconsciousness within 30 minutes.

>2500 ppm: Potential for collapse and death before warning symptoms. Additionally, if mixtures of this gas mixture contain less than 19.5% Oxygen and are released in a small, poorly ventilated area (i.e. an enclosed or confined space), an oxygen-deficient environment may occur. Individuals breathing such an atmosphere may experience symptoms which include headaches, ringing in ears, dizziness, drowsiness, unconsciousness, nausea, vomiting, and depression of all the senses. Under some circumstances of over-exposure, death may occur. The following effects associated with various levels of oxygen are as follows:

CONCENTRATION OF OXYGEN OBSERVED EFFECT

12-16% Oxygen: 10-14% Oxygen: 6-10% Oxygen:

Below 6%

200-2500 ppm:

Breathing and pulse rate increased, muscular coordination slightly disturbed. Emotional upset, abnormal fatigue, disturbed respiration.

Nausea, vomiting, collapse, or loss of consciousness.

Convulsive movements, possible respiratory collapse, and death.

SKIN and EYE CONTACT: Hydrogen Sulfide, a component of this gas mixture, may be irritating to the skin. Inflammation and irritation of the eyes can occur at very low airborne concentration of Hydrogen Sulfide (less than 10 ppm). Exposure over several hours may result in "gas eyes" or "sore eyes" with symptoms of scratchiness, irritation, tearing and burning. Above 50 ppm of Hydrogen Sulfide, there is an intense tearing, blurring of vision, and pain when looking at light. Over-exposed individuals may see rings around bright lights. Most symptoms disappear when exposure ceases. However, in serious cases, the eye can be permanently damaged. HEALTH EFFECTS OR RISKS FROM EXPOSURE: An Explanation in Lay Terms. Over-exposure to this gas mixture may cause the following

health effects:

ACUTE: Due to the small size of the individual cylinder of this gas mixture, no unusual health effects from exposure to the product are anticipated under routine circumstances of use. However the Hydrogen Sulfide and Carbon Monoxide components of this gas mixture are toxic to humans. Over-exposure to this gas mixture can cause nausea, dizziness, headaches, collapse, unconsciousness, coma, and death. Due to the presence of Hydrogen Sulfide, over-exposures to this gas mixture can also irritate the skin and eyes; severe eye contamination can result in blindness.

CHRONIC: Severe over-exposures to the Hydrogen Sulfide component of this gas mixture, which do not result in death, may cause long-term symptoms such as memory loss, paralysis of facial muscles, or nerve tissue damage. In serious cases of over-exposure, the eyes can be permanently damaged. Skin disorders and respiratory conditions may be aggravated by repeated over-exposures to this gas product. Refer to Section 11 (Toxicology Information) for additional information on the components of this gas mixture. Chronic exposure to oxygen-deficient

atmospheres (below 18% oxygen in air) may affect the heart and nervous system. **TARGET ORGANS:** ACUTE: Respiratory system, blood system, central nervous system effects, cardiovascular system, skin, eyes. CHRONIC: Neurological system, reproductive system, eyes.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL **PROTECTIVE EQUIPMENT.** At a minimum, Self-Contained Breathing Apparatus must be worn. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental

oxygen and/or cardio-pulmonary resuscitation if necessary. **SKIN EXPOSURE:** If irritation of the skin develops after exposure to this gas mixture, <u>immediately</u> begin decontamination with running water. <u>Minimum</u> flushing is for 15 minutes. Remove exposed or contaminated clothing, taking care not to contaminate eyes. Victim must seek immediate medical attention

EYE EXPOSURE: If irritation of the eye develops after exposure to this gas mixture, open victim's eyes while under gentle running water. Use sufficient force to open eyelids. Have victim "roll" eyes. <u>Minimum</u> flushing is for 15 minutes. Seek medical assistance immediately, preferably an ophthalmologist.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Pre-existing respiratory conditions may be aggravated by over-exposure to this gas mixture. Carbon Monoxide, a component of this gas mixture, can aggravate some diseases of the cardiovascular system, such as coronary artery disease and angina pectoris. Because of the presence of Hydrogen Sulfide, eye disorders or skin problems may be aggravated by over-exposure to this gas mixture.

RECOMMENDATIONS TO PHYSICIANS: Treat symptoms and eliminate over-exposure. Hyperbaric oxygen is the most efficient antidote to Carbon Monoxide poisoning, the optimum range being 2-2.5 atm. A special mask, or, preferably, a compression chamber to utilize oxygen at these pressures is required. Avoid administering stimulant drugs. Be observant for initial signs of pulmonary edema in the event of severe inhalation over-exposures

5. FIRE-FIGHTING MEASURES

FLASH POINT: Not applicable. AUTOIGNITION TEMPERATURE: Not applicable. **NFPA RATING** FLAMMABLE LIMITS (in air by volume, %): Lower (LEL): Not applicable. Upper (UEL): Not applicable. 0 FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing 0 3 HEALTH REACTIVITY media appropriate for surrounding fire. UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture contains toxic gases, Hydrogen Sulfide and Carbon Monoxide, and presents an health hazard to firefighters. This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire. OTHER Explosion Sensitivity to Mechanical Impact: Not Sensitive. Explosion Sensitivity to Static Discharge: Not Sensitive. SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment. 6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of over-exposure to Hydrogen Sulfide and Carbon Monoxide, the toxic components of this gas mixture, and other safety hazards related to the remaining components of this gas mixture, than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel. For emergency disposal,

6. ACCIDENTAL RELEASE MEASURES (continued)

secure the cylinder and slowly discharge the gas to the atmosphere in a well-ventilated area or outdoors. Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for Hydrogen Sulfide, Carbon Monoxide, and Oxygen. Hydrogen Sulfide and Carbon Monoxide level must be below exposure level listed in Section 2 (Composition and Information on Ingredients) and Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue, especially if work is done in a poorly ventilated area; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to olfactory fatigue or oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify cylinders containing a gas mixture with Hydrogen Sulfide or Carbon Monoxide. If there is a malfunction or another type of operational problem, contact nearest distributor immediately. Eye wash stations/safety showers should be near areas where this gas mixture is used or stored. All work operations should be monitored in such a way that emergency personnel can be immediately contacted in the event of a release. All work practices should minimize releases of Hydrogen Sulfide and Carbon Monoxide-containing gas mixtures.

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C (70°F). Cylinders should be stored in dry, well-ventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure. PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental

Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Oxygen, Hydrogen Sulfide, and Carbon Monoxide. VENTILATION AND ENGINEERING CONTROLS:

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Use supplied air respiratory protection if the levels of components exceeds exposure limits presented in Section 2 (Composition and Information of Ingredients) and Oxygen levels are below 19.5%, or unknown, during emergency response to a release of this gas mixture. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.16.33% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998). The following NIOSH respiratory protection recommendations for Hydrogen Sulfide and Carbon Monoxide are provided for further information.

NIOSH/OSHA RECOMMENDATIONS FOR HYDROGEN SULFIDE CONCENTRATIONS IN AIR:

Powered air-purifying respirator with cartridge(s) to protect against hydrogen sulfide; gas mask with canister to protect against hydrogen sulfide; or SAR; or full-facepiece SCBA. Up to 100 ppm:

Emergency or Planned El	ntry into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-
	facepiece SAR with an auxiliary positive pressure SCBA.
Escape:	Gas mask with canister to protect against hydrogen sulfide; or escape-type SCBA
NOTÉ:	The IDLH concentration for Hydrogen Sulfide is 100 ppm.
NIOSH/OSHA RECOMM	ENDATIONS FOR CARBON MONOXIDE CONCENTRATIONS IN AIR:
Up to 350 ppm	Supplied Air Respirator (SAR)

Up to 350 ppm	Supplied Air Respirator (SAR)
Up to 875 ppm	Supplied Air Respirator (SAR) operated in a continuous flow mode.
Up to 1200 ppm	Gas mask with canister to protect against carbon monoxide; or full-facepiece SCBA; or full-facepiece Supplied Air
	Respirator (SAR).
Emergency or Planned Entr	y into Unknown Concentration or IDLH Conditions: Positive pressure, full-facepiece SCBA; or positive pressure, full-
	facepiece Supplied Air Respirator (SAR) with an auxiliary positive pressure SCBA.
Escape:	Gas mask with canister to protect against carbon monoxide; or escape-type SCBA.
	NOTE : End of Service Life Indicator (ESLI) required for gas masks.
NOTE:	The IDLH concentration for Carbon Monoxide is 1200 ppm.

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, the main component of this gas mixture. GAS DENSITY @ 32°F (0°C) and 1 atm: .072 lbs/ ft³ (1.153 kg/m³) FREEZING/MELTING POINT @ 10 psig: -345.8°F (-210°C) SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906 SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023 EVAPORATION RATE (nBuAc = 1): Not applicable. VAPOR PRESSURE @ 70°F (21.1°C) (psig): Not applicable. COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.

BOILING POINT: -320.4°F (-195.8°C) pH: Not applicable. MOLECULAR WEIGHT: 28.01 EXPANSION RATIO: Not applicable. SPECIFIC VOLUME (ft³/lb): 13.8

The following information is for this gas mixture.

ODOR THRESHOLD: 0.13 ppm (Hydrogen Sulfide)

APPEARANCE AND COLOR: This gas mixture is a colorless gas which has an rotten egg-like odor, due to the presence of Hydrogen Sulfide. HOW TO DETECT THIS SUBSTANCE (warning properties): Continuous inhalation of low concentrations of this gas mixture may cause olfactory fatigue, due to the presence of Hydrogen Sulfide, so the odor is not a good warning property of a release of this gas mixture. In terms of leak detection, fittings and joints can be painted with a soap solution to detect leaks, which will be indicated by a bubble formation. Wet lead acetate paper can be used for leak detection. The paper turns black in the presence of Hydrogen Sulfide. Cadmium chloride solutions can also be used. Cadmium solutions will turn yellow upon contact with Hydrogen Sulfide.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state.

DECOMPOSITION PRODUCTS: The thermal decomposition products of Methane include carbon oxides. The decomposition products of Hydrogen Sulfide include water and sulfur oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in Nitrogen (the main component of this gas mixture). Lithium reacts slowly with Nitrogen at ambient temperatures. Components of this gas mixture (Hydrogen Sulfide, Methane) are also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen, oxygen difluoride, and nitrogen trifluoride). Carbon Monoxide is mildly corrosive to nickel and iron (especially at high temperatures and pressures). Hydrogen Sulfide is corrosive to most metals, because it reacts with these substances to form metal sulfides

HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture: NITROGEN: CARBON MONOXIDE (continued):

unspecified)

- There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.
- METHANE:
- There are no specific toxicology data for Methane. Methane is a simple asphyxiant, which acts to displace oxygen in the environment.
- CARBON MONOXIDE:

- CARBON MONOXIDE: LC₅₀ (Inhalation-Rat) 1807 ppm/4 hours LC₅₀ (Inhalation-Mouse) 2444 ppm/4 hours LC₅₀ (Inhalation-Guinea Pig) 5718 ppm/4 hours LC₅₀ (Inhalation-Guinea Pig) 5718 ppm/4 hours LCLo (Inhalation-Human) 4 mg/m³/12 hours: Behavioral: coma; Vascular: BP lowering not characterized in autonomic section; Blood: methemoglobinemia-carboxyhemoglobin LCLo (Inhalation-Human) 5000 ppm/30 minutes LCLo (Inhalation-Human) 5000 ppm/30 minutes
- LCLo (Inhalation-Human) 5000 ppm/5 minutes LCLo (Inhalation-Dog) 4000 ppm/46 minutes
- LCLo (Inhalation-Rabbit) 4000 ppm LCLo (Inhalation-Mammal-species
- LCLo (Inhalation 5000 ppm/5 minutes TCLo (Inhalation-Human) 600 mg/m3/10 minutes: Behavioral: headache
- TCLo (Inhalation-Man) 650 ppm/45 minutes: Blood: methemoglobinemia-carboxyhemoglobin;
- Behavioral: changes in psychophysiological tests TCLo (Inhalation-Rat) 1800 ppm/1 hour/14 days-
- intermittent: Cardiac: other changes TCLo (Inhalation-Rat) 30 mg/m³/8 hours/10 weeks-intermittent: Brain and Coverings: other intermittent: Brain and degenerative changes: other Behavioral: muscle
- degenerative changes; Behavioral: muscle contraction or spasticity TCLo (Inhalation-Rat) 96 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes TCLo (Inhalation-Rat) 250 ppm/5 hours/20 days-intermittent: Blood: pigmented or nucleated red blood colls, colls, changes in other cell count
- blood cells, changes in other cell count (unspecified), changes in erythrocyte (RBC) count TDLo (Subcutaneous-Rat) 5983 mg/kg/18 weeks-
- intermittent: Blood: changes in serum composition (e.g. TP, bilirubin, cholesterol)
- TCLo (Inhalation-Monkey) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated
- red blood cells, other changes TCLo (Inhalation-Rabbit) 200 mg/m³/3 hours/13 weeks-intermittent: Brain and Coverings: other degenerative changes; Cardiac: other changes; Blood: hemorrhage
- TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/30 weeks-continuous: Cardiac: arrhythmias (including changes in conduction), EKG changes not diagnostic of specified effects, pulse rate increase, without fall in BP

- e) 50 ppm/30 Thorax, or Res (Inhalation-Mouse) TCLo days intermittent: Respiration: Lungs, structural or functional change in trachea or bronchi
- TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/4
- TCLo (Inhalation-Guinea Pig) 200 mg/m³/5 hours/4 weeks-intermittent: Endocrine: hyperglycemia
 TCLo (Inhalation-Guinea Pig) 200 ppm/24 hours/90 days-continuous: Blood: pigmented or nucleated red blood cells, other changes
 TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Maternal Effects: other effects; Effects on Newborn: behavioral behavioral
- TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Specific Developmental Abnormalities: cardiovascular (circulatory) system
- TCLo (Inhalation-Rat) 150 ppm/24 hours: female 1-22 day(s) after conception: Reproductive: Effects on Newborn: growth statistics (e.g.%, reduced weight gain), behavioral
- TCLo (Inhalation-Rat) 1 mg/m3/24 hours: female 72 day(s) pre-mating: Reproductive: Maternal Effects: menstrual cycle changes or disorders, parturition; Fertility: female fertility index (e.g. # females pregnant per # sperm positive females; # females pregnant per # females mated)
- TCLo (Inhalation-Rat) 150 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Effects on Newborn: behavioral
- TCLo (Inhalation-Rat) 75 ppm/24 hours: female 0-20 day(s) after conception: Reproductive: Specific Developmental Abnormalities: immune and Developmental Abnormareticuloendothelial system
- TCLo (Inhalation-Mouse) 65 ppm/24 hours: female 7-18 day(s) after conception: Reproductive:
- Effects on Newborn: behavioral TCLo (Inhalation-Mouse) 250 ppm/7 hours: female 6-15 day(s) after conception: Reproductive: Fertility: post-implantation mortality (e.g. dead and/or resorbed implants per total number of implants); Specific Developmental Abnormalities: musculoskeletal system
- TCLo (Inhalation-Mouse) 125 ppm/24 hours: female 7-18 day(s) after conception: Reproductive: Effects on Embryo or Fetus: fetotoxicity (except
- death, e.g., stunted fetus) TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Fertility: litter size (e.g. # fetuses per litter; measured before birth); Effects on Embryo or Fetus: fetotoxicity (except death, e.g., stunted fetus), fetal death

CARBON MONOXIDE (continued):

TCLo (Inhalation-Rabbit) 50 ppm/24 hours/8 weeks-continuous: Blood: changes in platelet count

- TCLo (Inhalation-Mouse) 8 pph/1 hour: female 8 day(s) after conception: Reproductive: Specific Developmental Abnormalities: Central Nervous . System
- TCLo (Inhalation-Rabbit) 180 ppm/24 hours: female 1-30 day(s) after conception: Reproductive: Effects on Newborn: stillbirth, viability index (e.g., # alive at day 4 per # born alive)
- Micronucleus Test (Inhalation-Mouse)1500 ppm/10 minutes
- Sister Chromatid Exchange (Inhalation-Mouse) 2500 ppm/10 minute

HYDROGEN SULFIDE:

- LC₅₀ (Inhalation-Rat) 444 ppm: Lungs, Thorax, or Respiration: other changes; Gastrointestinal: hypermotility, diarrhea; Kidney, Ureter, Bladder: urine volume increased
- LC₅₀ (Inhalation-Mouse) 634 ppm/1 hour LCLo (Inhalation-Human) 600 ppm/30 minutes
- LCLo (Inhalation-Man) 5700 µg/kg: Behavioral: coma; Lungs, Thorax, or Respiration: chronic
- pulmonary edema LCLo (Inhalation-Human) 800 ppm/5 minutes LCLo (Inhalation-Mammal-species unspecified) 800
- ppm/5 minutes TCLo (Inhalation-Rat) 30 ppm/6 hours/10 weeks-intermittent: Sense Organs and Special Senses (Olfaction): olfactory nerve change, effect, not
- otherwise specified
- TCLo (Inhalation-Rat) 1200 mg/m³/2 hours/5 days-intermittent: Brain and Coverings: other degenerative changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: true cholinesterase
- TCLo (Inhalation-Rat) 100 ppm/8 hours/5 weeks-intermittent: Brain and Coverings: other degenerative changes; Lungs, Thorax, or Respiration: other changes; Biochemical: Enzyme inhibition, induction, or change in blood or tissue levels: cytochrome oxidases (including oxidative phosphorylation)
- TCLo (Inhalation-Rat) 80 ppm/6 hours/90 days-intermittent: Brain and Coverings: changes in brain weight: Nutritional and Gross Metabolic: weight loss or decreased weight gain TCLo (Inhalation-Rat) 20 ppm: female 6-22 day(s)
- after conception lactating female 21 day(s) post-birth: Reproductive: Effects on Newborn: physical
- TCLo (Inhalation-Mouse) 80 ppm/6 hours/90 days-intermittent: Nutritional and Gross Metabolic: weight loss or decreased weight gain; Related to Chronic Data: death TCLo (Inhalation-Rabbit) 40 mg/m³/5 hours/30
- weeks-intermittent: Sense Organs and Special Senses (Eye): conjunctive irritation

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies. IRRITANCY OF PRODUCT: This gas mixture is irritating to the eyes, and may be irritating to the skin. SENSITIZATION OF PRODUCT: The components of this gas mixture are not known to be skin or respiratory sensitizers.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture on the human reproductive system.

Embryotoxicity: This gas mixture contains components that may cause embryotoxic effects in humans; however, due to the small total amount of the components, embryotoxic effects are not expected to occur.

Teratogenicity: This gas mixture is not expected to cause teratogenic effects in humans due to the small cylinder size and small total amount of all components. The Carbon Monoxide component of this gas mixture which exists up to 1%, can cause teratogenic effects in humans. Severe exposure to Carbon Monoxide during pregnancy has caused adverse effects and the death of the fetus. In general, maternal symptoms are an indicator of the potential risk to the fetus since Carbon Monoxide is toxic to the mother before it is toxic to the fetus.

<u>Reproductive Toxicity</u>: The components of this gas mixture are not reported to cause adverse reproductive effects in humans. A <u>mutagen</u> is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An embryotoxin is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A teratogen is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A <u>reproductive toxin</u> is any substance which interferes in any way with the reproductive process. BIOLOGICAL EXPOSURE INDICES (BEIs): Biological Exposure Indices (BEIs) have been determined for components of this gas mixture, as

follows:

CHEMICAL DETERMINANT	SAMPLING TIME	BEI
CARBON MONOXIDE • Carboxyhemoglobin in blood • Carbon monoxide in end-exhaled air	• End of shift • End of shift	• 3.5% of hemoglobin • 20 ppm

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The gas will be dissipated rapidly in well-ventilated areas. The following environmental data are applicable to the components of this gas mixture.

CARBON MONOXIDE:

Atmospheric Fate: A photochemical model was used to quantify the sensitivity of the tropospheric oxidants ozone (O₃) and OH to changes in methane (CH₄), Carbon Monoxide (CO), and NO emissions and to perturbations in climate and stratospheric chemistry. In most cases, increased CH₄ and CO emissions will suppress OH (negative coefficients) in increased O₃ (positive coefficients) except in areas where NO and O₃ influenced by pollution are sufficient to increased OH. In most regions, NO, CO, and CH₄ emission increased will suppress OH and increased O₃, but these trends may be opposed by stratospheric O3 depletion and climate change. HYDROGEN SULFIDE:

Water Solubility = 1 g/242 mL at 20°C.

Plant toxicity: Continuous fumigation of plants with 300 or 3000 ppb Hydrogen Sulfide caused leaf lesions, defoliation, and reduced growth with severity of injury correlated to dose. At higher (3.25 and 5.03 ppm) Hydrogen Sulfide, significant reductions in leaf CO2 and water vapor exchanges occurred, and stomatal openings were depressed. When Hydrogen Sulfide gas was applied to 29 species of green plants for 5 hours, young, rapidly elongating tissues were more sensitive to injury than older tissues. Symptoms included scorching of young shoots and

<u>Mutagenicity</u>: The components of this gas mixture are not reported to cause mutagenic effects in humans. **REPRODUCTIVE TOXICITY INFORMATION (continued)**:

12. ECOLOGICAL INFORMATION(continued)

leaves, basal and marginal scorching of older leaves. Mature leaves were unaffected. Seeds exposed to Hydrogen Sulfide gas showed delay in germination

Persistence: Converts to elemental sulfur upon standing in water.

Major Species Threatened: Aquatic and animal life plants may be injured if exposed to 5 ppm in air over 24 hours.

Biodegradation: Microorganisms in soil and water are involved in oxidation-reduction reactions that oxidize hydrogen sulfide to elemental sulfur. Members of the genera Beggiatoa, Thioploca, and Thiotrix function in transition zones between aerobic and anaerobic conditions where both molecular oxygen and hydrogen sulfide are found. Also, some photosynthetic bacteria oxidize hydrogen sulfide to elemental sulfur. Members of the families Chlorobiaceae and Chromatiaceae (purple sulfur bacteria) are obligate aerobes and are phototropic, and are found in waters with high H₂S concentrations. The interactions of these organisms form part of the global sulfur cycle.

Bioconcentration: Does not have bioaccumulation or food chain contamination potential.

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C; 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on this gas mixture's effects on plant and animal life. Hydrogen Sulfide and Carbon Monoxide, components of this gas mixture, can be deadly to exposed animal life, producing symptoms similar to those experienced by humans. This gas mixture may also be harmful to plant life.

EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on this gas mixture's effects on aquatic life. The presence of more than a trace of the Carbon Monoxide component of this gas mixture is a hazard to fish. The following aquatic toxicity data are available for the Hydrogen Sulfide component of this gas mixture:

HYDROGEN SULFIDE:	HYDROGEN SULFIDE (continued):	HYDROGEN SULFIDE (continued):			
LC_{50} (Asellus arthropods) 96 hours = 0.111	LC ₅₀ ,F (bluegill, 35-day-old fry) 96 hours =	Lethal (goldfish) 96 hours = 10 mg/L			
mg/L	0.0131 mg/L	Toxic (carp) 24 hours = 3.3 mg/L			
LC_{50} (<i>Crangon</i> arthropods) 96 hours = 1.07	LC ₅₀ ,F (bluegill, juveniles) 96 hours = 0.0478	Toxic (goldfish) 24 hours = 4.3 mg/L			
mg/L	mg/L	Toxic (sunfish) 1 hour = 4.9 to 5.3 mg/L			
LC ₅₀ (Gammarus arthropods) 96 hours =	LC_{50} , F (bluegill, adults) 96 hours = 0.0448	Toxic (goldfish) 200 hours = 5 mg/L			
0.84 mg/L	mg/L	Toxic (minnows) 24 hours = 5-6 mg/L			
LC_{50} (Ephemera) 96 hours = 0.316 mg/L	LC ₅₀ ,F (fathead minnows) 96 hours =	Toxic (carp) 24 hours = 6-25 mg/L			
LC_{50} (Inhalation-Flies) > 960 minutes = 380	0.0071-0.55 mg/L	Toxic (trout) 15 minutes = 10 mg/L			
mg/m ³	LC_{50} , F (bluegill) 96 hours = 0.0090-0.0140	Toxic (goldfish) 24 hours = 25 mg/L			
LC_{50} (Inhalation-Flies) 7 minutes = 1,500	mg/L	Toxic (tench) 3 hours = 100 mg/L			
mg/m ³	LC_{50} , F (brook trout) 96 hours = 0.0216-	MATC,F (fathead minnows) 0.0037 mg/L			
LC_{50} ,F (bluegill, eggs) 72 hours = 0.0190	0.0308 mg/L	MATC,F (bluegill) 0.0004 mg/L			
mg/L	Toxic (goldfish) = 100 mg/L	MATC,F (brook trout) 0.055 mg/L			
13. DISPOSAL CONSIDERATIONS					
DEPARTNE WASTES FOR DISPOSAL DEPARTNE WASTES FOR DISPOSAL. Waste disposal must be in assertance with appropriate					

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information).

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION. PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to

Nitrogen.		
HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)	
UN IDENTIFICATION NUMBER:	UN 1956	
PACKING GROUP:	Not Applicable	
DOT LABEL(S) REQUIRED:	Non-Flammable Gas	
NORTH AMERICAN EMERGENCY RESPONSE O	GUIDEBOOK NUMBER (2000):	126
U.S. DEPARTMENT OF TRANSPORTATION INFOR	RMATION (continued):	

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101, Appendix B)

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself.

TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas mixture is considered as Dangerous Goods, per regulations of Transport Canada.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen.

HAZARD CLASS NUMBER and DESCRIPTION:	2.2 (Non-Flammable Gas)
UN IDENTIFICATION NUMBER:	UN 1956
PACKING GROUP:	Not Applicable
HAZARD LABEL:	Class 2.2 (Non-Flammable Gas)
SPECIAL PROVISIONS:	None
EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX:	0.12
ERAP INDEX:	3000
PASSENGER CARRYING SHIP INDEX:	Forbidden
PASSENGER CARRYING ROAD VEHICLE OR PASSENG	GER CARRYING RAILWAY VEHICLE INDEX: Forbidden
NORTH AMERICAN EMERGENCY RESPONSE GUIDEBO	OOK NUMBER (2000): 126

NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: This gas mixture is subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act, as follows:

CHEMICAL NAME	SARA 302	SARA 304	SARA 313
	(40 CFR 355, Appendix A)	(40 CFR Table 302.4)	(40 CFR 372.65)
Hydrogen Sulfide	YES	YES	YES

U.S. SARA THRESHOLD PLANNING QUANTITY: Hydrogen Sulfide = 500 lb (227 kg)

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Hydrogen Sulfide = 100 lb (45 kg)

OTHER U.S. FEDERAL REGULATIONS:

Hydrogen Sulfide and Carbon Monoxide are subject to the reporting requirements of CFR 29 1910.1000. Hydrogen Sulfide and Methane are subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for each of these gases is 10,000 pounds and so this mixture will not be affected by the regulation.

Depending on specific operations involving the use of this gas mixture, the regulations of the Process Safety Management of Highly Hazardous Chemicals may be applicable (29 CFR 1910.119). Hydrogen Sulfide is listed in Appendix A of this regulation. The Threshold Quantity for Hydrogen Sulfide under this regulation is 1500 lbs (and so one cylinder of this gas mixture will not be affected by this regulation).

This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR part 82). Nitrogen and Oxygen are not listed Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Hydrogen Sulfide is listed under this regulation in Table 1 as a Regulated Substance (Toxic Substance), in quantities of 10,000 lbs (4,553 kg) or greater.

15. REGULATORY INFORMATION(continued)

Carbon Monoxide and Methane are listed under this regulation in Table 3, as Regulated Substances (Flammable), in quantities of 10,000 lbs (4,553 kg) or greater, and so this mixture will not be affected by the regulation. **U.S. STATE REGULATORY INFORMATION**: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane.

- California Permissible Exposure Limits for Chemical Contaminants: Carbon Monoxide,
- Nitrogen, Hydrogen Sulfide, Methane.
 Florida Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide
- Illinois Toxic Substance List: Carbon Monoxide, Methane. Hvdrogen Sulfide.

Methane, Hydrogen Sulfide. Kansas - Section 302/313 List: No.

Massachusetts - Substance List: Oxygen, Carbon Monoxide, Hydrogen Sulfide, Methane. Michigan - Critical Materials Register: No. Minnesota - List of Hazardous Substances: Carbon Monoxide, Hydrogen Sulfide, Methane. Missouri - Employer Information/Toxic Substance List t: Hydrogen Sulfide Methane

- Issouri Employer Information/Toxic Rhode is Substance List t: Hydrogen Sulfide, Methane. Oxygen, ew Jersey - Right to Know Hazardous Sulfide, I Substance List: Oxygen, Carbon Monoxide, Texas - H
- Nitrogen, Methane. North Dakota - List of Hazardous Chemicals, Reportable Quantities: Hydrogen Sulfide.

Pennsylvania - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.

- Sulfide, Methane. Rhode Island - Hazardous Substance List: Oxygen, Carbon Monoxide, Nitrogen, Hydrogen Sulfide, Methane.
- Texas Hazardous Substance List: Hydrogen Sulfide. West Virginia - Hazardous Substance List:
- Hydrogen Sulfide. Wisconsin - Toxic and Hazardous Substances: Hydrogen Sulfide

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): The Carbon Monoxide component of this gas mixture is on the California Proposition 65 lists. WARNING! This gas mixture contains a compound known to the State of California to cause birth defects or other reproductive harm.

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists.

CANADIAN WHMIS CLASSIFICATION: This gas mixture is categorized as a Controlled Product, Hazard Classes A and D2A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch etc.). When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1	"Safe Handling of Compressed Gases in Containers"
AV-1	"Safe Handling and Storage of Compressed Gases"
	"Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519 619/670-0609

Fax on Demand: 1-800/231-1366



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition.

SAFETY DATA SHEET

Helium

Section 1. Identification

GHS product identifier	:	Helium
Chemical name	:	Helium
Other means of identification	:	helium (dot); Helium-4; He; o-Helium; UN 1046
Product use	:	Synthetic/Analytical chemistry.
Synonym SDS #	1	helium (dot); Helium-4; He; o-Helium; UN 1046 001025
Supplier's details	:	Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Emergency telephone number (with hours of	:	1-866-734-3438

operation)

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	: GASES UNDER PRESSURE - Compressed gas
GHS label elements	
Hazard pictograms	
Signal word	: Warning
Hazard statements	: Contains gas under pressure; may explode if heated. May displace oxygen and cause rapid suffocation.
Precautionary statements	
General	: Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.
Prevention	: Use and store only outdoors or in a well ventilated place.
Response	: Not applicable.
Storage	 Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal	: Not applicable.
Hazards not otherwise classified	: In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.



Section 3. Composition/information on ingredients

Substance/mixture Chemical name Other means of identification

: Substance

- : Helium
 - : helium (dot); Helium-4; He; o-Helium; UN 1046

CAS number/other identifiers

CAS number	: 7440-59-7
Product code	: 001025

Ingredient name	%	CAS number
Helium	100	7440-59-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: As this product is a gas, refer to the inhalation section.

Most important symptoms	effects, acute and delayed	
Potential acute health eff	<u>icts</u>	
Eye contact	: Contact with rapidly expanding gas may cause burns or frostbite.	
Inhalation	: No known significant effects or critical hazards.	
Skin contact	: Contact with rapidly expanding gas may cause burns or frostbite.	
Frostbite	: Try to warm up the frozen tissues and seek medical attention.	
Ingestion	: As this product is a gas, refer to the inhalation section.	
Over-exposure signs/sym	<u>ptoms</u>	
Eye contact	: No specific data.	
Inhalation	: No specific data.	
Skin contact	: No specific data.	
Ingestion	: No specific data.	
Indication of immediate me	dical attention and special treatment needed, if necessary	
Notes to physician	 Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled. 	
Date of issue/Date of revision	: 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 2	/11

Large spill

Section 4. First aid measures

Specific treatments Protection of first-aiders : No specific treatment.

: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures **Extinguishing media** Suitable extinguishing : Use an extinguishing agent suitable for the surrounding fire. media Unsuitable extinguishing : None known. media Specific hazards arising : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode. from the chemical Hazardous thermal : No specific data. decomposition products Special protective actions : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable for fire-fighters training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. Fire-fighters should wear appropriate protective equipment and self-contained breathing **Special protective** ŝ, apparatus (SCBA) with a full face-piece operated in positive pressure mode. equipment for fire-fighters

Section 6. Accidental release measures

Personal precautions, protect	<u>tiv</u>	e equipment and emergency procedures
For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	:	Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Methods and materials for co	nt	ainment and cleaning up
Small spill	:	Immediately contact emergency personnel. Stop leak if without risk.

: Immediately contact emergency personnel. Stop leak if without risk. Note: see Section

1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling			
Protective measures	:	Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.	
Advice on general occupational hygiene	:	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.	
Conditions for safe storage, including any incompatibilities	:	Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).	

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Helium	Oxygen Depletion [Asphyxiant]

Appropriate engineering controls	: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.
Environmental exposure controls	: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.
Individual protection measure	<u>ires</u>
Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

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Section 8. Exposure controls/personal protection

Hand protection	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

<u>Appearance</u>			
Physical state	: Gas. [Compressed gas.]		
Color	: Colorless.		
Molecular weight	: 4 g/mole		
Molecular formula	: He		
Boiling/condensation point	: -268.9°C (-452°F)		
Melting/freezing point	: -272.2°C (-458°F)		
Critical temperature	: -267.9°C (-450.2°F)		
Odor	: Odorless.		
Odor threshold	: Not available.		
рН	: Not available.		
Flash point	: [Product does not sustain combustion.]		
Burning time	: Not applicable.		
Burning rate	: Not applicable.		
Evaporation rate	: Not available.		
Flammability (solid, gas)	: Not available.		
Lower and upper explosive (flammable) limits	: Not available.		
Vapor pressure	: Not available.		
Vapor density	: 0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft3 (125 kg/m3)		
Specific Volume (ft ³ /lb)	: 96.1538		
Gas Density (lb/ft ³)	: 0.0104		
Relative density	: Not applicable.		
Solubility	: Not available.		
Solubility in water	: Not available.		
Partition coefficient: n- octanol/water	: 0.28		
Auto-ignition temperature	: Not available.		
Decomposition temperature	: Not available.		
Date of issue/Date of revision	: 10/15/2014. Date of previous issue : 10/2/2014.	Version : 0.02	5/11

Date of issue/Date of revision

Section 9. Physical and chemical properties

SADT Viscosity : Not available. : Not applicable.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

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ious issue : 10/2/

Section 11. Toxicological information

Information on the likely routes of exposure	:	Not available.
Potential acute health effects		
Eye contact	1	Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation	1	No known significant effects or critical hazards.
Skin contact	1	Contact with rapidly expanding gas may cause burns or frostbite.
Ingestion	:	As this product is a gas, refer to the inhalation section.
Symptoms related to the physical	sic	al, chemical and toxicological characteristics
Eye contact	1	No specific data.
Inhalation	:	No specific data.
Skin contact	1	No specific data.
Ingestion	:	No specific data.
Delayed and immediate effect	ts :	and also chronic effects from short and long term exposure
<u>Short term exposure</u>		
Potential immediate effects	:	Not available.
Potential delayed effects	1	Not available.
<u>Long term exposure</u>		
Potential immediate effects	:	Not available.
Potential delayed effects	:	Not available.
Potential chronic health effe	ct	<u>S</u>
Not available.		
General	:	No known significant effects or critical hazards.
Carcinogenicity	:	No known significant effects or critical hazards.
Mutagenicity	1	No known significant effects or critical hazards.
Teratogenicity	1	No known significant effects or critical hazards.
Developmental effects	1	No known significant effects or critical hazards.
Fertility effects	:	No known significant effects or critical hazards.
Numerical measures of toxici	<u>ty</u>	
• • • • • • • • •		

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Date of issue/Date of revision

: 10/15/2014. Date of previous issue

us issue : 10/2/2014.

Section 12. Ecological information

Bioaccumulative potential

Product/ingredient name	LogPow	BCF	Potential
Helium	0.28	-	low

Mobility in soil

Soil/water partition	: Not available.
coefficient (Koc)	

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

- **Disposal methods**
- : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	ΙΑΤΑ
UN number	UN1046	UN1046	UN1046	UN1046	UN1046
UN proper shipping name	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED
Transport hazard class(es)	2.2	2.2	2.2	2.2	2.2
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	Limited quantity Yes. Packaging instruction Passenger aircraft Quantity limitation: 75 kg Cargo aircraft Quantity limitation: 150 kg	Explosive Limit and Limited Quantity Index 0.125 Passenger Carrying Road or Rail Index 75	-	-	Passenger and Cargo AircraftQuantity limitation: 75 kg Cargo Aircraft Only Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 14. Transport information

Special precautions for user	1	Transport within user's premises: always transport in closed containers that are
		upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according : Not available. to Annex II of MARPOL 73/78 and the IBC Code

Section 15. Regulatory information

	5	
U.S. Federal regulations	: TSCA 8(a) CDR Exempt/Partial exemption: Not determined	
	United States inventory (TSCA 8b): This material is listed or exempted.	
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	: Not listed	
Clean Air Act Section 602 Class I Substances	: Not listed	
Clean Air Act Section 602 Class II Substances	: Not listed	
DEA List I Chemicals (Precursor Chemicals)	: Not listed	
DEA List II Chemicals (Essential Chemicals)	: Not listed	
SARA 302/304 Composition/information	on ingredients	
No products were found.		
SARA 304 RQ	: Not applicable.	
SARA 311/312		
Classification	: Sudden release of pressure	
Composition/information	on ingredients	

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Helium	100	No.	Yes.	No.	No.	No.

State regulations Massachusetts

- : This material is listed.
- **New York**
- : This material is not listed.
- **New Jersey**
- : This material is listed.
- Pennsylvania
- : This material is listed.
- **Canada inventory**
- : This material is listed or exempted.
- International regulations

Powered by IHS

9/11

Section 15. Regulatory information

International lists	: Australia inventory (AICS): This material is listed or exempted.
	China inventory (IECSC): This material is listed or exempted.
	Japan inventory: Not determined.
	Korea inventory: This material is listed or exempted.
	Malaysia Inventory (EHS Register): Not determined.
	New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
	Philippines inventory (PICCS): This material is listed or exempted.
	Taiwan inventory (CSNN): Not determined.
Chemical Weapons	: Not listed
Convention List Schedule	
I Chemicals	
Chemical Weapons	: Not listed
Convention List Schedule	
II Chemicals	
Chemical Weapons	: Not listed
Convention List Schedule	
III Chemicals	
<u>Canada</u>	
WHMIS (Canada)	: Class A: Compressed gas.
	CEPA Toxic substances: This material is not listed.
	Canadian ARET: This material is not listed.

Canadian NPRI: This material is not listed. Alberta Designated Substances: This material is not listed. Ontario Designated Substances: This material is not listed. Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Date of issue/Date of revision : 10/15/2014. Date of previous i	issue : 10/2/2014. Version : 0.0.	10/11
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Section 16. Other information

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

: 10/15/2014.
: 10/15/2014.
: 10/2/2014.
: 0.02
: ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = Internediate Bulk Container IMDG = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA) CFR – United States Code of Federal Regulations CPR – Controlled Products Regulations DSL – Domestic Substances List GWP – Global Warming Potential IARC – International Agency for Research on Cancer ICAO – International Agency for Research on Cancer ICAO – International Agency for Research on Cancer ICAO – International Civil Aviation Organisation Inh – Inhalation LC – Lethal concentration LD – Lethal dosage NDSL – Non-Domestic Substances List NIOSH – National Institute for Occupational Safety and Health TDG – Canadian Transportation of Dangerous Goods Act and Regulations TLV – Threshold Limit Value TSCA – Toxic Substances Control Act WEEL – Workplace Environmental Exposure Level WHMIS – Canadian Workplace Hazardous Material Information System
: Not available.

✓ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Date of issue/Date of revision : 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 11/3	Date of issue/Date of revision	: 10/15/2014.	Date of previous issue	: 10/2/2014.	Version : 0.02	2 11/1
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MATERIAL SAFETY DATA SHEET HORIBA INSTRUMENTS, INC. 17671 Armstrong Avenue, Irvine, CA 92614 (949) 250-4811

REVISION DATE MAY 2003

		EVISION DATE MAT 2003
SECTION I: MATERIAL IDENTIFI	ATION	
IDENTITY: Potassium hydrogen phthalate P/N 350623, 527033, 696138-1, 9003001	00, 100-4	
CHEMICAL FORMULA: C ₆ H ₄ (COOK)(C	OOH) ~1% in water	
GENERIC NAME: pH 4 Buffer Sc	ution	
CHEMICAL FAMILY: Salt solution		
OTHER DESIGNATION: pH 4 Standard	Solution, Autocal solution,	100-4
IN CASE OF EMERGENCY CON	ACT YOUR REGIONAL F	PLANT MANAGER
SECTION II: HAZARDOUS INGRE	DIENTS	
Irritant: Eyes, nose and throat, skin.		
This product contains the following toxic c	emical(s) subject to Secti	on 313
SECTION III: PHYSICAL DATA	(1372): NONE	
MELTING POINT (*): 295-300 ℃	PECIFIC GRAVITY (H ₂ O =	= 1): 1 636
VAPOR PRESSURE: N/A	ERCENT. VOLATILE BY	VOLUME (%): None
SOLUBILITY IN WATER v/v @ ^o C: 1 APPEARANCE AND ODOR: 0	2% (cool water) (olorless liquid	CAS #: 877-24-7
SECTION IV: PHYSICAL DATA		
FLASH POINT AND METHOD:	N/A	
FLAMMABLE LIMITS:	None	
EXTINGUISHING MEDIA:	Determine bas combustibles.	sed on surrounding
SPECIAL FIRE FIGHTING PROCEDURE	: None	
UNUSUAL FIRE AND EXPLOSION HAZA	RDS: N/A	
SECTION V: REACTIVITY DATA		
STABILITY: S	able at normal temperatu	ſe
INCOMPATIBILITY (MATERIALS TO AV	ID): None	
HAZARDOUS DECOMPOSITION PRODU	CTS: None	
HAZARDOUS POLYMERIZATION:	None	
	1	

SECTION VI: HEALTH HAZARD DATA

EMERGENCY AND FIRST AID PROCEDURES:

Eyes: Wash eyes with clean water flowing for 10-15 minutes. Call doctor immediately. Skin: Take off contaminated clothing and wash skin with water.

Inhaled: Move the patient into clear air. Keep patient warm and stable. Loosen clothing and use artificial respiration if necessary. Call doctor immediately.

Swallowed: Give patient plenty of warm water/milk. Induce vomiting. Call doctor immediately. If patient is unconscious, do not give water/milk, but call doctor immediately.

SECTION VII: SPILL OR LEAK PROCEDURES Highway or railway spills call Chemtrec (800) 424-9300

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: Collect as much material as possible. The place of leakage should be washed with plenty of water.

WASTE DISPOSAL METHOD: Dispose as chemical waste.

SECTION VIII: SPECIAL PROTECTION INFORMATION

RESPIRATORY PROTECTION (SPECIFY TYPE):

VENTILATION:

Not normally required.

Not normally required.

OTHER PROTECTIVE EQUIPMENT:

Optional - eye mask, gloves and long-sleeve working clothes.

SECTION IX:SPECIAL PRECAUTIONS

PRECAUTIONS TO BE TAKEN IN HANDLING AND STORING: After working, wash hands thoroughly.

OTHER PRECAUTIONS: None.

For the following RAE Part Numbers:

600-0001-000, 600-0002-000 600-0002-001, 600-0026-000

600-0027-000, 600-0069-000

MATERIAL SAFETY DATA SHEET

AIR LIQUIDE

Prepared to U.S. OSHA, CMA, ANSI and Canadian WHMIS Standards

1. PRODUCT IDENTIFICATION

CHEMICAL NAME; CLASS: NONFLAMMABLE GAS MIXTURE

Containing One or More of the Following Components in a Nitrogen Balance Gas: Oxygen 0-23.5%; Isobutylene, 0.0005-0.9%

SYNONYMS: Not Applicable

CHEMICAL FAMILY NAME: Not Applicable

FORMULA: Not Applicable

Document Number: 50054

Note: The Material Safety Data Sheet is for this gas mixture supplied in cylinders with 33 cubic feet (935 liters) or less gas capacity (DOT - 39 cylinders). This MSDS has been developed for various gas mixtures with the composition of components within the ranges listed in Section 2 (Composition and Information on Ingredients). Refer to the product label for information on the actual composition of the product.

PRODUCT USE: SUPPLIER/MANUFACTURER'S NAME: ADDRESS:

EMERGENCY PHONE: BUSINESS PHONE: General MSDS Information: Calibration of Monitoring and Research Equipment CALGAZ 821 Chesapeake Drive Cambridge, MD 21613 CHEMTREC: 1-800-424-9300 1-410-228-6400 1-713/868-0440 1-800/231-1366

2. COMPOSITION and INFORMATION ON INGREDIENTS

CHEMICAL NAME	CAS #	mole %	EXPOSURE LIMITS IN AIR					
			ACGIH-TLV		ACGIH-TLV OSHA-PEL		NIOSH	OTHER
			TWA	STEL	TWA	STEL	IDLH	
			ppm	ppm	ppm	ppm	ppm	ppm
Isobutylene	115-11-7	0.0005-0.9%	There are no specific exposure limits for Isobutylene.					
Oxygen	7782-44-7	0-23.5%	There are no specific exposure limits for Oxygen.					
Nitrogen	7727-37-9	Balance	There are no specific exposure limits for Nitrogen. Nitrogen is a simple asphyxiant (SA). Oxygen levels should be maintained above 19.5%.					

NE = Not Established. See Section 16 for Definitions of Terms Used.

NOTE (1): ALL WHMIS required information is included in appropriate sections based on the ANSI Z400.1-1998 format. This gas mixture has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.

3. HAZARD IDENTIFICATION

EMERGENCY OVERVIEW: This is a colorless, odorless gas mixture. Releases of this gas mixture may produce oxygen-deficient atmospheres (especially in confined spaces or other poorly-ventilated environments); individuals in such atmospheres may be asphyxiated. Isobutylene, a component of this gas mixture, may cause drowsiness and other central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

SYMPTOMS OF OVER-EXPOSURE BY ROUTE OF EXPOSURE: The most significant

Fax on Demand:

	E BI ROOTE OF EXI COURE. The most significant						
route of over-exposure for this gas m INHALATION: Due to the small size	ixture is by inhalation.	н	AZARDO	OUS MATERIAL ID	ENTIFICA	TION SY	STEN
health effects from over-exposu	re to the product are anticipated under routine						
circumstances of use. The chief heat gas mixture contains less than 19.5	alth hazard associated with this gas mixture is when this % Oxvoen and is released in a small, poorly-ventilated	H	EALTH	HAZARD		(BLUE)	1
area (i.e. an enclosed or confined	space). Under this circumstance, an oxygen-deficient						
environment may occur. Individu	als breathing such an atmosphere may experience						
symptoms which include head	aches, ringing in ears, dizziness, drowsiness,						
unconsciousness, nausea, vomiting	g, and depression of all the senses. Under some	Fl	LAMM	ABILITY HAZ	zard	(RED)	0
circumstances of over-exposure, de	eath may occur. The effects associated with various						
levels of oxygen are as follows:							
CONCENTRATION OF OXYGEN	OBSERVED EFFECT						
12-16% Oxygen:	Breathing and pulse rate increase, muscular coor-	P	HYSIC	AL HAZARD) (M	ELLOW)	0
10 14% () () ()	dination slightly disturbed.	11.			,	. ,	Ŭ
10-14% Oxygen.	emotional upset, apriormal fatigue, disturbed						
6-10% Oxygen:	Nausea, vomiting, collapse, or loss of consciousness.						T
Below 6%:	Convulsive movements, possible respiratory collapse,	11	PRC	JECTIVE	EQUIF		1
	and death.						
HEALTH EFFECTS OR RISKS FRO	JM EXPOSURE: An Explanation in Lay Terms. Over-		EYES	RESPIRATORY	HANDS	BC	DY
exposure to this gas mixture may car	use the following health effects:						
ACUTE: Due to the small size of	the individual cylinder of this gas mixture, no unusual			See Sect	ion 8		
health effects from exposure to the	product are anticipated under routine circumstances of			500 5000	0		
use. The most significant hazard as	sociated with this gas mixture when it contains less than						

19.5% oxygen is the potential for exposure to oxygen-deficient atmospheres. Symptoms of oxygen deficiency include respiratory difficulty, ringing in ears, headaches, shortness of breath, wheezing, headache, dizziness, indigestion, nausea, unconsciousness, and death. The skin of a victim of over-exposure may have a blue

color. Additionally, isobulylene, accomponent of this gas mixture, may cause drowsiness or central nervous system effects in high concentrations; however, due to its low concentration in this gas mixture, this is unlikely to occur.

CHRONIC: Chronic exposure to oxygen-deficient atmospheres (below 18% oxygen in air) may affect the heart and nervous system. TARGET ORGANS: ACUTE: Respiratory system, eyes. CHRONIC: Heart, cardiovascular system, central nervous system.

4. FIRST-AID MEASURES

RESCUERS SHOULD NOT ATTEMPT TO RETRIEVE VICTIMS OF EXPOSURE TO THIS GAS MIXTURE WITHOUT ADEQUATE PERSONAL PROTECTIVE EQUIPMENT. At a minimum, Self-Contained Breathing Apparatus must be worn. No unusual health effects are anticipated after exposure to this gas mixture, due to the small cylinder size. If any adverse symptom develops after

over-exposure to this gas mixture, remove victim(s) to fresh air as quickly as possible. Only trained personnel should administer supplemental oxygen and/or cardio-pulmonary resuscitation if necessary. Victim(s) who experience any adverse effect after over-exposure to this gas mixture must be taken for medical attention. Rescuers should be taken for medical attention if necessary. Take a copy of the label and the MSDS to physician or other health professional with victim(s).

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Acute or chronic respiratory conditions may be aggravated by over-exposure to this gas mixture

RECOMMENDATIONS TO PHYSICIANS: Administer oxygen, if necessary; treat symptoms and eliminate exposure.

5. FIRE-FIGHTING MEASURES

NFPA RATING

FLAMMABILITY

0

OTHER

1

HEALTH

0

REACTIVITY

FLASH POINT: Not applicable.

AUTOIGNITION TEMPERATURE: Not applicable. FLAMMABLE LIMITS (in air by volume, %):

<u>Lower (LEL)</u>: Not applicable. <u>Upper (UEL)</u>: Not applicable.

FIRE EXTINGUISHING MATERIALS: Non-flammable gas mixture. Use extinguishing media appropriate for surrounding fire.

UNUSUAL FIRE AND EXPLOSION HAZARDS: This gas mixture is not flammable; however, containers, when involved in fire, may rupture or burst in the heat of the fire.

Explosion Sensitivity to Mechanical Impact: Not sensitive.

Explosion Sensitivity to Static Discharge: Not sensitive.

SPECIAL FIRE-FIGHTING PROCEDURES: Structural firefighters must wear Self-Contained Breathing Apparatus and full protective equipment.

6. ACCIDENTAL RELEASE MEASURES

LEAK RESPONSE: Due to the small size and content of the cylinder, an accidental release of this gas mixture presents significantly less risk of an oxygen deficient environment and other safety hazards than a similar release from a larger cylinder. However, as with any chemical release, extreme caution must be used during emergency response procedures. In the event of a release in which the atmosphere is unknown, and in which other chemicals are potentially involved, evacuate immediate area. Such releases should be responded to by trained personnel using pre-planned procedures. Proper protective equipment should be used. In case of a leak, clear the affected area, protect people, and respond with trained personnel.

Allow the gas mixture to dissipate. If necessary, monitor the surrounding area (and the original area of the release) for oxygen. Oxygen levels must be above 19.5% before non-emergency personnel are allowed to re-enter area. If leaking incidentally from the cylinder, contact your supplier.

7. HANDLING and USE

WORK PRACTICES AND HYGIENE PRACTICES: Be aware of any signs of dizziness or fatigue; exposures to fatal concentrations of this gas mixture could occur without any significant warning symptoms, due to oxygen deficiency. Do not attempt to repair, adjust, or in any other way modify the cylinders containing this gas mixture. If there is a malfunction or another type of operational problem, contact nearest distributor immediatelv

STORAGE AND HANDLING PRACTICES: Cylinders should be firmly secured to prevent falling or being knocked-over. Cylinders must be protected from the environment, and preferably kept at room temperature (approximately 21°C [70°F]). Cylinders should be stored in dry, wellventilated areas, away from sources of heat, ignition, and direct sunlight. Protect cylinders against physical damage. Full and empty cylinders should be segregated. Use a first-in, first-out inventory system to prevent full containers from being stored for long periods of time. These cylinders are not refillable. WARNING! Do not refill DOT 39 cylinders. To do so may cause personal injury or property damage.

SPECIAL PRECAUTIONS FOR HANDLING GAS CYLINDERS: WARNING! Compressed gases can present significant safety hazards. During cylinder use, use equipment designed for these specific cylinders. Ensure all lines and equipment are rated for proper service pressure

PROTECTIVE PRACTICES DURING MAINTENANCE OF CONTAMINATED EQUIPMENT: Follow practices indicated in Section 6 (Accidental Release Measures). Make certain that application equipment is locked and tagged-out safely. Always use product in areas where adequate ventilation is provided.

8. EXPOSURE CONTROLS - PERSONAL PROTECTION

VENTILATION AND ENGINEERING CONTROLS: No special ventilation systems or engineering controls are needed under normal circumstances of use. As with all chemicals, use this gas mixture in well-ventilated areas. If this gas mixture is used in a poorly-ventilated area, install automatic monitoring equipment to detect the levels of Nitrous Oxide and Oxygen.

RESPIRATORY PROTECTION: No special respiratory protection is required under normal circumstances of use. Maintain oxygen levels above 19.5% in the workplace. Use supplied air respiratory protection when oxygen levels are below 19.5%, or during emergency response to a release of this gas mixture. During an emergency situation, before entering the area, check the concentration of Methane and Oxygen. If respiratory protection is needed, use only protection authorized in the U.S. Federal OSHA Standard (29 CFR 1910.134), applicable U.S. State regulations, or the Canadian CSA Standard Z94.4-93 and applicable standards of Canadian Provinces. Oxygen levels below 19.5% are considered IDLH by OSHA. In such atmospheres, use of a full-facepiece pressure/demand SCBA or a full facepiece, supplied air respirator with auxiliary self-contained air supply is required under OSHA's Respiratory Protection Standard (1910.134-1998).

EYE PROTECTION: Safety glasses. If necessary, refer to U.S. OSHA 29 CFR 1910.133 or appropriate Canadian Standards.

HAND PROTECTION: Wear leather gloves when handling cylinders. Chemically resistant gloves should be worn when using this gas mixture. If necessary, refer to U.S. OSHA 29 CFR 1910.138 or appropriate Standards of Canada.

BODY PROTECTION: No special protection is needed under normal circumstances of use. If a hazard of injury to the feet exists due to falling objects, rolling objects, where objects may pierce the soles of the feet or where employee's feet may be exposed to electrical hazards, use foot protection, as described in U.S. OSHA 29 CFR 1910.136.

9. PHYSICAL and CHEMICAL PROPERTIES

The following information is for Nitrogen, a main component of this	gas mixture.
GAS DENSITY @ 32°F (0°C) and 1 atm: 0.072 lbs/ ft ³ (1.153 kg/m ³)	
BOILING POINT: -195.8°C (-320.4°F)	FREEZING/MELTING POINT @ 10 psig: -210°C (-345.8°F)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 0.906	pH: Not applicable.
SOLUBILITY IN WATER vol/vol @ 32°F (0°C) and 1 atm: 0.023	MOLECULAR WEIGHT: 28.01
EVAPORATION RATE (nBuAc = 1): Not applicable.	EXPANSION RATIO: Not applicable.
ODOR THRESHOLD: Not applicable.	SPECIFIC VOLUME (ft ³ /lb): 13.8
VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.	COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
The following information is for Oxygen, a main component of this g	as mixture.
GAS DENSITY @ 32°F (0°C) and 1 atm: 0.083 lb/cu ft (1.326 kg/m ³)	
FREEZING/MELTING POINT @ 10 psig: -218.8°C (-361.8°F)	BOILING POINT: -183.0°C (-297.4°F)
SPECIFIC GRAVITY (air = 1) @ 70°F (21.1°C): 1.105	pH: Not applicable.
SOLUBILITY IN WATER vol/vol at 32°F (0°C) and 1 atm: 0.04.91	MOLECULAR WEIGHT: 32.00
EVAPORATION RATE (nBuAc = 1): Not applicable.	EXPANSION RATIO: Not applicable.
ODOR THRESHOLD: Not applicable.	VOLUME (ft ³ /lb): 12.1
VAPOR PRESSURE @ 70°F (21.1°C) psig: Not applicable.	COEFFICIENT WATER/OIL DISTRIBUTION: Not applicable.
The following information is for the gas mixture.	
APPEARANCE AND COLOR: This is a colorless, odorless gas mixture	2.
HOW TO DETECT THIS SUBSTANCE (warning properties): There	are no unusual warning properties associated with a release of this gas
misture in terms of lock detection fittings and joints can be pointed.	with a seen adultion to detect looks, which will be indicated by a bubble

formation.

10. STABILITY and REACTIVITY

STABILITY: Normally stable in gaseous state. DECOMPOSITION PRODUCTS: The thermal decomposition products of Isobutylene include carbon oxides. The other components of this gas mixture do not decompose, per se, but can react with other compounds in the heat of a fire.

MATERIALS WITH WHICH SUBSTANCE IS INCOMPATIBLE: Titanium will burn in the Nitrogen component of this gas mixture. Lithium reacts slowly with Nitrogen at ambient temperatures. The Isobutylene component of this gas mixture is also incompatible with strong oxidizers (i.e. chlorine, bromine pentafluoride, oxygen difluoride, and nitrogen trifluoride). HAZARDOUS POLYMERIZATION: Will not occur.

CONDITIONS TO AVOID: Contact with incompatible materials. Cylinders exposed to high temperatures or direct flame can rupture or burst.

11. TOXICOLOGICAL INFORMATION

TOXICITY DATA: The following toxicology data are available for the components of this gas mixture:

ISOBUTYLENE:

LC₅₀ (inhalation, rat) = 620,000 mg/kg/4 hours LC₅₀ (inhalation, mouse) = 415,000 mg/kg

NITROGEN:

There are no specific toxicology data for Nitrogen. Nitrogen is a simple asphyxiant, which acts to displace oxygen in the environment.

SUSPECTED CANCER AGENT: The components of this gas mixture are not found on the following lists: FEDERAL OSHA Z LIST, NTP, CAL/OSHA, and IARC; therefore, they are not considered to be, nor suspected to be, cancer-causing agents by these agencies

IRRITANCY OF PRODUCT: Contact with rapidly expanding gases can be irritating to exposed skin and eyes. SENSITIZATION TO THE PRODUCT: The components of this gas mixture are not known to cause human skin or respiratory sensitization.

REPRODUCTIVE TOXICITY INFORMATION: Listed below is information concerning the effects of this gas mixture and its components on the human reproductive system.

Mutagenicity: No mutagenicity effects have been described for the components in this gas mixture.

Embryotoxcity: No embryotoxic effects have been described for the components in this gas mixture. Teratogenicity: No teratogenicity effects have been described for the components in this gas mixture.

Reproductive Toxicity: No reproductive toxicity effects have been described for the components in gas mixture.

A <u>mutagen</u> is a chemical which causes permanent changes to genetic material (DNA) such that the changes will propagate through generation lines. An <u>embryotoxin</u> is a chemical which causes damage to a developing embryo (i.e. within the first eight weeks of pregnancy in humans), but the damage does not propagate across generational lines. A <u>teratogen</u> is a chemical which causes damage to a developing fetus, but the damage does not propagate across generational lines. A <u>reproductive toxin</u> is any substance which interferes in any way with the reproductive process. BIOLOGICAL EXPOSURE INDICES (BEIs): Currently, Biological Exposure Indices (BEIs) are not applicable for the components of this gas mixture.

12. ECOLOGICAL INFORMATION

ENVIRONMENTAL STABILITY: The components of this gas mixture occur naturally in the atmosphere. The gas will be dissipated rapidly in wellventilated areas. The following environmental data are applicable to the components of this gas mixture.

OXYGEN: Water Solubility = 1 volume Oxygen/32 volumes water at 20°C. Log Kow = -0.65

NITROGEN: Water Solubility = 2.4 volumes Nitrogen/100 volumes water at 0°C. 1.6 volumes Nitrogen/100 volumes water at 20°C.

EFFECT OF MATERIAL ON PLANTS or ANIMALS: No evidence is currently available on the effects of this gas mixture on plant and animal life. EFFECT OF CHEMICAL ON AQUATIC LIFE: No evidence is currently available on the effects of this gas mixture on aquatic life.

3. DISPOSAL CONSIDERATIONS

PREPARING WASTES FOR DISPOSAL PREPARING WASTES FOR DISPOSAL: Waste disposal must be in accordance with appropriate Federal, State, and local regulations. Cylinders with undesired residual product may be safely vented outdoors with the proper regulator. For further information, refer to Section 16 (Other Information)

14. TRANSPORTATION INFORMATION

THIS GAS MIXTURE IS HAZARDOUS AS DEFINED BY 49 CFR 172.101 BY THE U.S. DEPARTMENT OF TRANSPORTATION.

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas) UN 1956

UN IDENTIFICATION NUMBER: Not applicable.

PACKING GROUP

DOT LABEL(S) REQUIRED: DOT LABEL(S) REQUIRED: Class 2.2 (Non-Flammable Gas) NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126

MARINE POLLUTANT: The components of this gas mixture are not classified by the DOT as Marine Pollutants (as defined by 49 CFR 172.101,

Appendix B)

SPECIAL SHIPPING INFORMATION: Cylinders should be transported in a secure position, in a well-ventilated vehicle. The transportation of compressed gas cylinders in automobiles or in closed-body vehicles can present serious safety hazards. If transporting these cylinders in vehicles, ensure these cylinders are not exposed to extremely high temperatures (as may occur in an enclosed vehicle on a hot day). Additionally, the vehicle should be well-ventilated during transportation.

Note: DOT 39 Cylinders ship in a strong outer carton (overpack). Pertinent shipping information goes on the outside of the overpack. DOT 39 Cylinders do not have transportation information on the cylinder itself TRANSPORT CANADA TRANSPORTATION OF DANGEROUS GOODS REGULATIONS: This gas is considered as Dangerous Goods, per

regulations of Transport Canada

PROPER SHIPPING NAME: Compressed gases, n.o.s. (*Oxygen, Nitrogen)*or the gas component with the next highest concentration next to Nitrogen

HAZARD CLASS NUMBER and DESCRIPTION: 2.2 (Non-Flammable Gas) UN IDENTIFICATION NUMBER: UN 1956 PACKING GROUP: Not Applicable HAZARD LABEL: SPECIAL PROVISIONS: Class 2.2 (Non-Flammable Gas) None EXPLOSIVE LIMIT AND LIMITED QUANTITY INDEX: 0 12 ERAP INDEX: None PASSENGER CARRYING SHIP INDEX: None PASSENGER CARRYING ROAD VEHICLE OR PASSENGER CARRYING RAILWAY VEHICLE INDEX: 75 NORTH AMERICAN EMERGENCY RESPONSE GUIDEBOOK NUMBER (2000): 126 NOTE: Shipment of compressed gas cylinders via Public Passenger Road Vehicle is a violation of Canadian law (Transport Canada

Transportation of Dangerous Goods Act, 1992).

15. REGULATORY INFORMATION

ADDITIONAL U.S. REGULATIONS:

U.S. SARA REPORTING REQUIREMENTS: The components of this gas mixture are not subject to the reporting requirements of Sections 302, 304, and 313 of Title III of the Superfund Amendments and Reauthorization Act.

U.S. SARA THRESHOLD PLANNING QUANTITY: There are no specific Threshold Planning Quantities for this gas mixture. The default Federal MSDS submission and inventory requirement filing threshold of 10,000 lb (4,540 kg) may apply, per 40 CFR 370.20.

U.S. TSCA INVENTORY STATUS: The components of this gas mixture are listed on the TSCA Inventory.

U.S. CERCLA REPORTABLE QUANTITY (RQ): Not applicable.

OTHER U.S. FEDERAL REGULATIONS:

No component of this gas mixture is subject to the requirements of CFR 29 1910.1000 (under the 1989 PELs).

· Isobutylene is subject to the reporting requirements of Section 112(r) of the Clean Air Act. The Threshold Quantity for this gas is 10,000 pounds.

• The regulations of the Process Safety Management of Highly Hazardous Chemicals are not applicable (29 CFR 1910.119).

This gas mixture does not contain any Class I or Class II ozone depleting chemicals (40 CFR Part 82).

15. REGULATORY INFORMATION (continued)

Nitrogen and Oxygen are not listed as Regulated Substances, per 40 CFR, Part 68, of the Risk Management for Chemical Releases. Isobutylene is listed under this regulation in Table 3 as Regulated Substances (Flammable Substances), in quantities of 10,000 lbs (4,554 ka) or areater.

U.S. STATE REGULATORY INFORMATION: The components of this gas mixture are covered under the following specific State regulations:

Alaska - Designated Toxic and Hazardous Substances: No. California - Permissible Exposure Limits for Chemical Contaminants: Nitrogen. Florida - Substance List: Oxygen, Isobutylene. Illinois - Toxic Substance List: No. Kansas - Section 302/313 List: No. Massachusetts - Substance List: Oxygen, Isobutylene. Michigan - Critical Materials Register: No. Minnesota - List of Hazardous Substances: No. Missouri - Employer Information/Toxic Substance List: No. New Jersey - Right to Know Hazardous Substance List: Oxygen, Nitrogen, Isobutylene. North Dakota - List of Hazardous Chemicals, Reportable Quantities: No. Pennsylvania - Hazardous Substance List: Oxygen, Nitrogen, Isobutylene. Rhode Island - Hazardous Substance List: Oxygen, Nitrogen. Texas - Hazardous Substance List: No. West Virginia - Hazardous Substance List: No. Wisconsin - Toxic and Hazardous Substances: : No.

CALIFORNIA SAFE DRINKING WATER AND TOXIC ENFORCEMENT ACT (PROPOSITION 65): No component of this gas mixture is on the California Proposition 65 lists

ADDITIONAL CANADIAN REGULATIONS:

CANADIAN DSL/NDSL INVENTORY STATUS: The components of this gas mixture are listed on the DSL Inventory.

CANADIAN ENVIRONMENTAL PROTECTION ACT (CEPA) PRIORITIES SUBSTANCES LISTS: The components of this gas mixture are not on the CEPA Priorities Substances Lists

CANADIAN WHMIS REGULATIONS: This gas mixture is categorized as a Controlled Product, Hazard Class A, as per the Controlled Product Regulations.

16. OTHER INFORMATION

INFORMATION ABOUT DOT-39 NRC (Non-Refillable Cylinder) PRODUCTS

DOT 39 cylinders ship as hazardous materials when full. Once the cylinders are relieved of pressure (empty) they are not considered hazardous material or waste. Residual gas in this type of cylinder is not an issue because toxic gas mixtures are prohibited. Calibration gas mixtures typically packaged in these cylinders are Nonflammable n.o.s., UN 1956. A small percentage of calibration gases packaged in DOT 39 cylinders are flammable or oxidizing gas mixtures.

For disposal of used DOT-39 cylinders, it is acceptable to place them in a landfill if local laws permit. Their disposal is no different than that employed with other DOT containers such as spray paint cans, household aerosols, or disposable cylinders of propane (for camping, torch When feasible, we recommended recycling for scrap metal content. CALGAZ will do this for any customer that wishes to return etc.). cylinders to us prepaid. All that is required is a phone call to make arrangements so we may anticipate arrival. Scrapping cylinders involves some preparation before the metal dealer may accept them. We perform this operation as a service to valued customers who want to participate.

MIXTURES: When two or more gases or liquefied gases are mixed, their hazardous properties may combine to create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an Industrial Hygienist or other trained person when you make your safety evaluation of the end product. Remember, gases and liquids have properties which can cause serious injury or death.

Further information about the handling of compressed gases can be found in the following pamphlets published by: Compressed Gas Association Inc. (CGA), 1725 Jefferson Davis Highway, Suite 1004, Arlington, VA 22202-4102. Telephone: (703) 412-0900.

P-1 AV-1

'Safe Handling of Compressed Gases in Containers' "Safe Handling and Storage of Compressed Gases" "Handbook of Compressed Gases"

PREPARED BY:

CHEMICAL SAFETY ASSOCIATES, Inc. PO Box 3519, La Mesa, CA 91944-3519 619/670-0609 Fax on Demand: 1-800/231-1366



This Material Safety Data Sheet is offered pursuant to OSHA's Hazard Communication Standard, 29 CFR, 1910.1200. Other government regulations must be reviewed for applicability to this gas mixture. To the best of CALGAZ knowledge, the information contained herein is reliable and accurate as of this date; however, accuracy, suitability or completeness are not guaranteed and no warranties of any type, either express or implied, are provided. The information contained herein relates only to this specific product. If this gas mixture is combined with other materials, all component properties must be considered. Data may be changed from time to time. Be sure to consult the latest edition



SAFETY DATA SHEET

Creation Date 08-Nov-2010

Revision Date 18-Jun-2015

Revision Number 2

1. Identification

Product Name

AC119170000; AC119170250; AC119171000; AC119175000

Cat No. :

Synonyms

Benzo[j,k]fluorene

Laboratory chemicals.

Fluoranthene

Recommended Use

Uses advised against No Information available Details of the supplier of the safety data sheet

Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100 Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410 Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity

Category 4

Label Elements

Signal Word Warning

Hazard Statements

Harmful if swallowed



Precautionary Statements Prevention

Wash face, hands and any exposed skin thoroughly after handling Do not eat, drink or smoke when using this product Ingestion IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell Rinse mouth **Disposal** Dispose of contents/container to an approved waste disposal plant <u>Hazards not otherwise classified (HNOC)</u> Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component		CAS-No	Weight %		
Fluoranthene		206-44-0	>95		
	4.	First-aid measures			
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.				
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.				
Inhalation	Move to fresh	n air. If breathing is difficult, give oxyge	n. Obtain medical attention.		
Ingestion	Do not induce vomiting. Get medical attention.				
Most important symptoms/effects Notes to Physician	ts No information available. Treat symptomatically				
	5. Fir	re-fighting measures			
Suitable Extinguishing Media	Water spray.	Carbon dioxide (CO 2). Dry chemical. a	lcohol-resistant foam.		
Unsuitable Extinguishing Media	No informatio	n available			
Flash Point Method -	100 °C / 21 No informatio	12 °F n available			
Autoignition Temperature Explosion Limits	No informatio	n available			
Upper Lower	No data available No data available				
Sensitivity to Mechanical Impac Sensitivity to Static Discharge	t No informatio No informatio	n available n available			
Specific Hazards Arising from the C Keep product and empty container aw	hemical ay from heat a	nd sources of ignition.			

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

<u>NFPA</u> Health 2	Flammability 0	Instability 0	Physical hazards N/A
	6. Accidental re	lease measures	
Personal Precautions	Ensure adequate ventilation	n. Use personal protective equ	ipment.

Г

Environmental Precautions	See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.			
Methods for Containment and Clear Up	n Sweep up or vacuum up spillage and collect in suitable container for disposal.			
	7. Handling and storage			
Handling	Ensure adequate ventilation. Wear personal protective equipment. Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Avoid dust formation.			
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.			
8. Ex	xposure controls / personal protection			
Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.			
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.			
Personal Protective Equipment				
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.			
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.			
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.			
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.			

9.	Physical and chemical properties
Physical State	Powder Solid
Appearance	Light green
Odor	Odorless
Odor Threshold	No information available
рН	No information available
Melting Point/Range	109 - 111 °C / 228.2 - 231.8 °F
Boiling Point/Range	384 - 34 °C / 723.2 - 93.2 °F
Flash Point	100 °C / 212 °F
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	No information available
Relative Density	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C16 H10
Molecular Weight	202.25

		10. Stabil	lity and rea	activity			
Reactive Hazard		None known, based	one known, based on information available				
Stability		Stable under norma	al conditions.				
Conditions to Avoid		Incompatible produc	cts.				
Incompatible Material	e	Strong oxidizing ag	ente				
	5						
Hazardous Decompos	Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO ₂)						
Hazardous Polymeriza	rization Hazardous polymerization does not occur.						
Hazardous Reactions		None under normal	processing.				
		11. Toxico	logical info	ormation			
Acute Toxicity							
Product Information Component Information	on	No acute toxicity inf	ormation is avail	able for this produc	ot		
Component		LD50 Oral		LD50 Dermal	LC50	Inhalation	
Fluoranthene		2 g/kg (Rat)	318	0 mg/kg (Rabbit)	No	t listed	
Products Delayed and immedia	Products Delayed and immediate effects as well as chronic effects from short and long-term exposure						
Irritation		No information avai	lable				
Sensitization		No information avai	lable				
Carcinogenicity		The table below ind	icates whether e	ach agency has lis	ted any ingredient	as a carcinogen.	
Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico	
Fluoranthene	206-44-0	Not listed	Not listed	Not listed	Not listed	Not listed	
Mutagenic Effects		No information avai	lable				
Reproductive Effects		No information avai	lable.				
Developmental Effects	s	No information avai	lable.				
Teratogenicity		No information avai	lable.				
STOT - single exposu STOT - repeated expo	re sure	None known None known					
Aspiration hazard		No information available					
Symptoms / effects,b	oth acute and	No information avai	lable				
delayed Endocrine Disruptor I	nformation	No information avai	lable				
Other Adverse Effects	5	The toxicological pr complete informatio	operties have no n.	t been fully investig	gated. See actual e	ntry in RTECS for	

12. Ecological information

Ecotoxicity Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Fluoranthene	Not listed	Oncorhynchus mykiss: LC50=0.0077 mg/L 96h	Not listed	EC50: 0.78 mg/L 20h
Persistence and Degrada	bility No information	on available		

Bioaccumulation/ Accumulation

No information available.

Mobility

Component	log Pow
Fluoranthene	5.33

13. Disposal considerations

Waste Disposal Methods

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Fluoranthene - 206-44-0	U120	-

	14. Transport information
DOT	
UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Proper technical name	(Fluoranthene)
Hazard Class	9
Packing Group	
TDG	
UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III
IATA	
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Packing Group	
IMDG/IMO	
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Packing Group	
	15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Fluoranthene	Х	-	Х	205-912-4	-		-	Х	Х	Х	-

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Fluoranthene	206-44-0	>95	1.0 0.1

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Fluoranthene	-	-	Х	Х

Clean Air Act

Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Fluoranthene	100 lb	-
		· · ·

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Fluoranthene	Х	Х	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D1B Toxic materials



16. Other information

Prepared By

Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

Creation Date08-Nov-2010Revision Date18-Jun-2015Print Date18-Jun-2015Revision SummaryThis document

18-Jun-2015 18-Jun-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



SAFETY DATA SHEET

Revision Date 10-Feb-2015

Revision Number 1

	1. Identification	1			
Product Name	Fluorene				
Cat No. :	AC156130000; AC156130250;	AC156131000; AC156135000			
Synonyms	Diphenylenemethane	Diphenylenemethane			
Recommended Use	Laboratory chemicals.				
Uses advised against Details of the supplier of the safe	No Information available ty data sheet				
Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100	Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887			

2. Hazard(s) identification

Classification

Classification under 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Label Elements None required

Hazards not otherwise classified (HNOC)

Very toxic to aquatic life with long lasting effects May form combustible dust concentrations in air

3. Composition / information on ingredients

Component Fluorene		CAS-No	Weight %			
		86-73-7	98			
	4.	First-aid measures				
Eye Contact	Rinse immedi Obtain medic	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.				
Skin Contact	Wash off imm	Wash off immediately with soap and plenty of water while removing all contaminated				
Skin Contact	Obtain medic Wash off imm	Obtain medical attention. Wash off immediately with soap and plenty of water while removing all contamina				

Most important symptoms/effects Notes to Physician	No information available. Treat symptomatically
Ingestion	Clean mouth with water. Get medical attention.
Inhalation	Remove from exposure, lie down. Move to fresh air. Obtain medical attention.
	clothes and shoes. Obtain medical attention.

5. Fire-fighting measures

	5 5
Suitable Extinguishing Media	Water spray. Carbon dioxide (CO 2). Dry chemical. chemical foam.
Unsuitable Extinguishing Media	No information available
Flash Point Method -	151 °C / 303.8 °F No information available
Autoignition Temperature Explosion Limits	Not applicable
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impac	t No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Dust can form an explosive mixture in air. Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous Combustion Products

None known

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health 0	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental re	elease measures	
Personal Precautions Environmental Precautions	Ensure adequate ventilation. Use personal protective equipment. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained.		
Methods for Containment and Cl Up	ean Sweep up or vacuum up this chemical enter the er	spillage and collect in suitable convironment.	ontainer for disposal. Do not let
	7. Handling	and storage	
Handling	Avoid contact with skin ar	nd eyes. Do not breathe dust. Do	o not ingest.
Storage	Keep in a dry, cool and w	ell-ventilated place. Keep conta	iner tightly closed.
8.	Exposure controls	/ personal protecti	on
Exposure Guidelines	This product does not cor established by the region	tain any hazardous materials w specific regulatory bodies.	ith occupational exposure limits
Engineering Measures	Ensure adequate ventilati	ion, especially in confined areas	

Personal Protective Equipment

Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	No protective equipment is needed under normal use conditions.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	Beige
Odor	Odorless
Odor Threshold	No information available
рН	No information available
Melting Point/Range	112 - 116 °C / 233.6 - 240.8 °F
Boiling Point/Range	298 °C / 568.4 °F @ 760 mmHg
Flash Point	151 °C / 303.8 °F
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	13 hPa @ 146 °C
Vapor Density	Not applicable
Relative Density	1.200
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	Not applicable
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C13 H10
Molecular Weight	166.22

10. Stability and reactivity

Reactive Hazard	None known, based on information available	
Stability	Stable under normal conditions.	
Conditions to Avoid	Incompatible products.	
Incompatible Materials	Strong oxidizing agents	
Hazardous Decomposition Products None under normal use conditions		
Hazardous Polymerization	No information available.	
Hazardous Reactions	None under normal processing.	
	11. Toxicological information	
Acute Toxicity		
Product Information Component Information	No acute toxicity information is available for this product	

Toxicologically Synergistic Products Delayed and immediate effects as w	No information available
Irritation	No information available
Sensitization	No information available
Carcinogenicity	The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Fluorene	86-73-7	Not listed	Not listed	Not listed	Not listed	Not listed
Mutagenic Effects		No information av	ailable		-	
Reproductive Effect	s	No information av	ailable.			
Developmental Effe	cts	No information available.				
Teratogenicity		No information available.				
STOT - single expos STOT - repeated ex	sure posure	None known None known				
Aspiration hazard		No information available				
Symptoms / effects	,both acute and	No information av	ailable			
Endocrine Disrupto	r Information	No information av	ailable			
Other Adverse Effe	cts	The toxicological complete informat	properties have no	been fully investig	gated. See actual e	entry in RTECS f

12. Ecological information

Ecotoxicity Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Persistence and Degradability	
Bioaccumulation/Accumulation	۱

Insoluble in water May persist No information available.

Mobility

. Is not likely mobile in the environment due its low water solubility.

Component	log Pow
Fluorene	4.18

	13. Disposal considerations
Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.
	14. Transport information
DOT	Not regulated
TDG	Not regulated
IATA	
UN-No	3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.*
Hazard Class	9
Packing Group	III
IMDG/IMO	

UN-No	3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III
	15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Fluorene	Х	Х	-	201-695-5	-		Х	Х	Х	Х	-

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated

polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable
SARA 313	Not applicable
CADA 244/242 Herendevia C	stagerization

SARA 311/312 Hazardous Categorization

The of the flazar doub outogon zation	
Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	Yes
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Fluorene	-	-	Х	Х

Clean Air Act

Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs	
Fluorene	5000 lb	-	

California Proposition 65	This product does not contain any Proposition 65 chemicals
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State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Fluorene	Х	Х	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

B4 Flammable solid



	16. Other information
Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Revision Date Print Date	10-Feb-2015 10-Feb-2015
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)
Disclaimer	

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



Material Name: Fuel Oil No. 2

Synonyms: #2 Heating Oil; 2 Oil; Off-road Diesel Fuel

SDS No. 0088 EU/CLP GHS

*** Section 1 - Product and Company Identification ***

Manufacturer Information

Hess Corporation 1 Hess Plaza Woodbridge, NJ 07095-0961 Phone: 732-750-6000 Corporate EHS Emergency # 800-424-9300 CHEMTREC www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquids - Category 3 Acute Toxicity, Inhalation - Category 4 Skin Corrosion/Irritation – Category 2 Eye Damage/Irritation – Category 2 Carcinogenicity - Category 2 Specific Target Organ Toxicity (Single Exposure) – Category 3 (respiratory irritation, narcosis) Aspiration Hazard – Category 1 Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)



Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor. Harmful if inhaled. Causes skin irritation. Causes eye irritation. Suspected of causing cancer. Suspected of causing genetic defects. May cause respiratory irritation. May cause drowsiness or dizziness. May be fatal if swallowed and enters airways.

Material Name: Fuel Oil No. 2

Precautionary Statements

Prevention

Keep away from heat/sparks/open flames/hot surfaces. No smoking Keep container tightly closed.

Ground/bond container and receiving equipment.

Use explosion-proof electrical/ventilating/lighting/equipment.

Use only non-sparking tools.

Take precautionary measures against static discharge.

Wear protective gloves/protective clothing/eye protection/face protection.

Avoid breathing fume/mist/vapors/spray.

Use only outdoors or in a well-ventilated area.

Wash hands and forearms thoroughly after handling.

Obtain special instructions before use.

Do not handle until all safety precautions have been read and understood.

Avoid release to the environment.

Response

In case of fire: Use water spray, fog or foam.

If on skin (or hair): Wash with plenty of soap and water. Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs, get medical advice/attention.

If inhaled: Remove person to fresh air and keep comfortable for breathing. Call a poison center or doctor if you feel unwell.

If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.

If exposed or concerned: Get medical advice/attention.

If swallowed: Immediately all a poison center or doctor/physician if you feel unwell. Do NOT induce vomiting.

Storage

Store in a well ventilated place. Keep cool. Keep container tightly closed. Store locked up.

Disposal

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients *

CAS #	Component	Percent
68476-30-2	Fuel oil No. 2	100
91-20-3	Naphthalene	<0.1

A complex combination of hydrocarbons with carbon numbers in the range C9 and higher produced from the distillation of petroleum crude oil.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or gaseous extinguishing agent.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

*** Section 6 - Accidental Release Measures ***

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Material Name: Fuel Oil No. 2

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

*** Section 7 - Handling and Storage ***

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when this product is loaded into tanks previously containing low flash point products (such as gasoline) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep containers closed and clearly labeled. Use approved vented storage containers. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers; Fluorel ®

Material Name: Fuel Oil No. 2

* * * **Section 8 - Exposure Controls / Personal Protection Component Exposure Limits** Fuel oil No. 2 (270-671-4) ACGIH: 100 mg/m3 TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel) Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel) Belgium: 100 mg/m3 TWA (as total hydrocarbon, aerosol and vapor) Skin (listed under Gas oil) Portugal: 100 mg/m3 TWA [VLE-MP] (aerosol and vapor, as total Hydrocarbons, listed under Fuel diesel) Naphthalene (202-049-5) ACGIH: 15 ppm STEL 10 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route 10 ppm TWA [TMW]; 50 mg/m3 TWA [TMW] Austria: skin notation Belgium: 15 ppm STEL; 80 mg/m3 STEL 10 ppm TWA; 53 mg/m3 TWA Skin Denmark: 10 ppm TWA; 50 mg/m3 TWA Finland: 2 ppm STEL; 10 mg/m3 STEL 1 ppm TWA; 5 mg/m3 TWA France: 10 ppm TWA [VME]; 50 mg/m3 TWA [VME] Germany: 0.1 ppm TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, inhalable fraction, exposure factor 1); 0.5 mg/m3 TWA AGW (The risk of damage to the embryo or fetus can be excluded when MAK and BAT values are observed, inhalable fraction, exposure factor 1) Greece: 10 ppm TWA; 50 mg/m3 TWA Ireland: 15 ppm STEL; 75 mg/m3 STEL 10 ppm TWA; 50 mg/m3 TWA Netherlands: 80 mg/m3 STEL 50 mg/m3 TWA 10 ppm TWA [VLE-MP] Portugal: 15 ppm STEL [VLA-EC]; 80 mg/m3 STEL [VLA-EC] Spain: 10 ppm TWA [VLA-ED]; 53 mg/m3 TWA [VLA-ED] skin - potential for cutaneous exposure 10 ppm LLV; 50 mg/m3 LLV Sweden: 15 ppm STV; 80 mg/m3 STV

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Material Name: Fuel Oil No. 2

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Red or reddish/orange colored (dyed)	Odor:	Mild, petroleum distillate odor
Physical State:	Liquid	pH:	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	Vapor Density:	>1.0
Boiling Point:	340 to 700 °F (171 to 371 °C)	Melting Point:	ND
Solubility (H2O):	Negligible	Specific Gravity:	AP 0.823-0871
Evaporation Rate:	Slow; varies with conditions	VOC:	ND
Octanol/H2O Coeff.:	ND	Flash Point:	100 °F (38 °C) minimum
Flash Point Method:	PMCC	Upper Flammability Limit	7.5
		(UFL):	
Lower Flammability Limit (LFL):	0.6	Burning Rate:	ND
Auto Ignition:	494°F (257°C)		

*** Section 10 - Chemical Stability & Reactivity Information ***

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers; Fluorel ®

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

*** Section 11 - Toxicological Information ***

Acute Toxicity

A: General Product Information

Harmful if swallowed.

Material Name: Fuel Oil No. 2

B: Component Analysis - LD50/LC50

Fuel oil No. 2 (68476-30-2)

Oral LD50 Rat 12 g/kg; Dermal LD50 Rabbit 4720 μL/kg; Dermal LD50 Rabbit >2000 mg/kg; Inhalation LC50 Rat 4.6 mg/L 4 h

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Product Mixture

Oral LD50 Rat 14.5 ml/kg; Dermal LD50 Rabbit >5 mL/kg; Guinea Pig Sensitization: negative; Primary dermal irritation: moderately irritating (Draize mean irritation score - 3.98 rabbits); Draize eye irritation: mildly irritating (Draize score, 48 hours, unwashed - 2.0 rabbits)

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This product is not reported to have any mutagenic effects. Material of similar composition has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

Dermal carcinogenicity: positive - mice

Material Name: Fuel Oil No. 2

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

This product is similar to Diesel Fuel. IARC classifies whole diesel fuel exhaust particulates as probably carcinogenic to humans (Group 2A) and NIOSH regards it as a potential cause of occupational lung cancer based on animal studies and limited evidence in humans.

B: Component Carcinogenicity

Fuel oil No. 2 (68476-30-2)

ACGIH: A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

NTP: Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)

IARC: Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

*** Section 12 - Ecological Information ***

Ecotoxicity

A: General Product Information

Very toxic to aquatic life with long lasting effects. Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow- through]	
Naphthalene (91-20-3)		
Test & Species		Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow- through]	

Material Name: Fuel Oil No. 2

96 Hr LC50 Oncorhynchus mykiss 0.91-2.82 mg/L [static] 96 Hr LC50 Pimephales promelas 1.99 mg/L [static] 96 Hr LC50 Lepomis macrochirus 31.0265 mg/L [static] 72 Hr EC50 Skeletonema costatum 0.4 mg/L 48 Hr LC50 Daphnia magna 2.16 mg/L 48 Hr EC50 Daphnia magna 1.96 mg/L [Flow through] 48 Hr EC50 Daphnia magna 1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

*** Section 13 - Disposal Considerations ***

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

*** Section 14 - Transportation Information ***

IATA Information

Shipping Name: Heating oil, light UN #: 1202 Hazard Class: 3 Packing Group: III

ICAO Information

Shipping Name: Heating oil, light UN #: 1202 Hazard Class: 3 Packing Group: III

IMDG Information

Shipping Name: Heating oil, light UN #: 1202 Hazard Class: 3 Packing Group: III

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SDS No. 0088

*** Section 15 - Regulatory Information ***

Regulatory Information

Component Analysis – Inventory

Component/CAS	EC #	EEC	CAN	TSCA
Fuel oil No. 2	270-671-4	EINECS	DSL	Yes
68476-30-2				
Naphthalene	202-049-5	EINECS	DSL	Yes
91-20-3				

* Section 16 - Other Information **

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet



Safety Data Sheet - Version 5.0

Preparation Date 9/15/2015 Latest Revision Date (If Revised) SDS Expiry Date 9/13/2018

1. IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1 Product Identifier

Chemical Name γ-Chlordane

Catalogue # C327040

1.2 Relevant Identified Uses of the Substance or Mixture and Uses Advised Against

Product Uses To be used only for scientific research and development. Not for use in humans or animals.

1.3 Details of the Supplier of the Safety Data Sheet

Company	Toronto Research Chemicals 2 Brisbane Road Toronto, ON M3J 2J8 CANADA	
Telephone FAX Email	+14166659696 +14166654439 orders@trc-canada.com	
1.4 Emergency Tel	ephone Number	



2. HAZARDS IDENTIFICATION

Emergency#

WHMIS Classification (Canada)

D2A Very Toxic Material Causing Other Toxic Effects Carcinogen WHMIS Symbols (Canada)

2.1/2.2 Classification of the Substance or Mixture and Label Elements GHS Hazards Classification (According to EU Regulation 1272/2008 and US OSHA 1910.1200)

+14166659696 between 0800-1700 (GMT-5)

Acute Toxicity, Oral (Category 4)

Carcinogenicity (Category 2)

Hazardous to the Aquatic Environment, Acute Hazard (Category 1)

EU Classification (According to EU Regulation 67/548/EEC)

Harmful if swallowed. May cause cancer. Very toxic to aquatic organisms.

EU Risk and Safety Statements (According to EU Regulation 67/548/EEC)

Hazard StatementsHazard CodesHarmfulXnEnvironmental HazardN



Risk Codes and Phrases

R22 Harmful if swallowed.

- R45 May cause cancer.
- R50 Very toxic to aquatic organisms.

Safety Precaution Codes and Phrases

S61 Avoid release to the environment. Refer to special instructions.

Toronto Research Chemicals - C327040Page 1This Safety Data Sheet contains 16 sections. All 16 sections must be present for this document to be valid.

S36/37/39 Wear suitable protective clothing, gloves and eye/face protection.

GHS Hazards Identification (According to EU Regulation 1272/2008 and US OSHA 1910.1200)

Signal Word Warning

GHS Hazard Statements

H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.

GHS Precautionary Statements

P273	Avoid release to the environment.
P281	Use personal protective equipment as required.

2.3 Unclassified Hazards/Hazards Not Otherwise Classified

No data available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Molecular Formula: C₁₀H₆Cl₈

CAS Registry #: 5103-74-2

Molecular Weight: 409.78 EC#: 225-826-0

Synonyms

 $(1R,2R,3aS,4S,7R,7aS)-rel-1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-,4,7-methano-1H-indene; (1\alpha,2\beta,3a\alpha,4\beta,7\beta,7a\alpha)-1,2,4,5,6,7,8,8-Octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methano-1H-indene; 1\beta,2\alpha,4\alpha,5,6,7\alpha,8,8-Octachloro-3a\beta,4,7,7a\beta-tetrahydro4,7-methanoindan; (±)-trans-Chlordane; trans-Chlordan; trans-1,2,4,5,6,7,8,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-endo-methanoindan; trans-Chlordan; trans-Chlordane; β-Chlordane; β-Chlordane;$

3.2 Mixtures

Not a mixture.

4. FIRST AID MEASURES

4.1 Description of First Aid Measures

General Advice

If medical attention is required, show this safety data sheet to the doctor.

If Inhaled

If inhaled, move person to fresh air. If not breathing, give artificial respiration and consult a physician.

In Case of Skin Contact

Wash affected area with soap and water. Consult a physician if any exposure symptoms are observed.

In Case of Eye Contact

Immediately rinse eyes with plenty of water for at least 15 minutes. Consult a physician.

If Swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Do NOT induce vomiting unless advised to do so by a physician or Poison Control Center. Seek medical attention.

4.2 Most Important Symptoms and Effects, Both Acute and Delayed

The most important known symptoms and effects are described in the labeling (see section 2.2) and/or in section 11.

4.3 Indication of any Immediate Medical Attention and Special Treatment Needed

No data available.

5. FIREFIGHTING MEASURES

5.1 Extinguishing Media

Toronto Research Chemicals - C327040 Page 2 This Safety Data Sheet contains 16 sections. All 16 sections must be present for this document to be valid.



Conditions of flammability

Not flammable or combustible.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.2 Special Hazards Arising from the Substance or Mixture

Carbon oxides, Hydrogen chloride

5.3 Advice for Firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further Information

No data available.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

Method and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Keep in a dry place.

Storage conditions: No Data Available

7.3 Specific End Uses

For scientific research and development only. Not for use in humans or animals.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control Parameters

Contains no components with established occupational exposure limits.

8.2 Exposure Controls

Appropriate Engineering Controls

A laboratory fumehood or other appropriate form of local exhaust ventilation should be used to avoid exposure.

Personal Protective Equipment

All recommendations below are advisory in nature and a risk assessment should be performed by the employer/end user prior to use of this product. The type of protective equipment must be selected based on the amount and concentration of the dangerous material being used in the workplace.

Eye/Face Protection

Safety goggles or face shield. All equipment should have been tested and approved under appropriate standards, such as NIOSH (US), CSA (Canada), or EN 166 (EU).

Skin Protection

Gloves should be used when handling this material. Gloves are to be inspected prior to use. Contaminated gloves are to be removed using proper glove removal technique so that the outer surface of the glove does not contact bare skin. Dispose of contaminated gloves after use in compliance with good laboratory practices and local requirements.

Toronto Research Chemicals - C327040Page 3This Safety Data Sheet contains 16 sections. All 16 sections must be present for this document to be valid.

Gloves used for incidental exposures (splash protection) should be designated as "chemical resistant" by EU standard EN 374 with the resistance codes corresponding to the anticipated use of the material. Unrated gloves are not recommended.

Suggested gloves: AnsellPro Sol-Vex nitrile gloves style 37-175, 15 mil thickness. Penetration time has not been determined.

Gloves used for prolonged direct exposure (immersion) should be designated "chemical resistant" as per EN 734 with the resistance codes corresponding to the anticipated use of the material. Suggested gloves: AnsellPro Viton/Butyl gloves style 38-612, 4/8 mil thickness. Penetration time has not been determined.

These recommendations may not apply if the material is mixed with any other chemical, or dissolved into a solution. A risk assessment must be performed to ensure the gloves will still offer acceptable protection.

Body Protection

Fire resistant (Nomex) coveralls or chemical-resistant bodysuit (laminated Tychem SL or equivalent).

Respiratory Protection

Recommended respirators are NIOSH-approved N100 or CEN-approved FFP3 particulate respirators. These are to be only used as a backup to local exhaust ventilation or other engineering controls. If the respirator is the only means of protection, a full-face supplied air respirator must be used.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on Basic Physical and Chemical	Properties
A) Appearance	B) Odour
No Data Available	odourless
C) Odour Threshold	D) pH
No data available.	No data available.
E) Melting Point/Freezing Point	F) Initial Boiling Point/Boiling Range
No Data Available	No data available.
G) Flash point	H) Evaporation Rate
No data available.	No data available.
I) Flammability (Solid/Gas)	J) Upper/Lower Flammability/Explosive Limits
No data available.	No data available.
K) Vapour Pressure	L) Vapour Density
No data available.	No data available.
M) Relative Density	N) Solubility
1.590 g/cm3	No Data Available
O) Partition Coefficient: n-octanol/water	P) Auto-Ignition Temperature
No data available.	No data available.
Q) Decomposition Temperature	R) Viscosity
No data available.	No data available.
S) Explosive Properties	T) Oxidizing Properties
No data available.	No data available.
9.2 Other Information	
10. STABILITY AND REACTIVITY	
10.1 Reactivity	
No data available.	
10.2 Chemical Stability	
Stable under recommended storage conditions	

10.3 Possibility of Hazardous Reactions

No data available.

10.4 Conditions to Avoid

No data available.

10.5 Incompatible Materials

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Strong oxidizing agents.

10.6 Hazardous Decomposition Products

Other decomposition products: No data available. In the event of fire: see section 5.

11. TOXICOLOGICAL INFORMATION

11.1 Information on Toxicological Effects

A) Acute Toxicity

Oral LD50: Mouse - 275 mg/kg

Rat - 1,100 mg/kg

B) Skin Corrosion/Irritation

No data available

C) Serious Eye Damage/Irritation

No data available

D) Respiratory or Skin Sensitization

No data available

E) Germ Cell Mutagenicity

No data available

F) Carcinogenicity

Evidence of a carcinogenic effect.

This compound has been designated by the IARC as Group 2B: Possibly carcinogenic to humans.

G) Reproductive Toxicity/Teratogenicity

No data available

H) Single Target Organ Toxicity - Single Exposure

No data available

I) Single Target Organ Toxicity - Repeated Exposure

No data available

J) Aspiration Hazard

No data available

K) Potential Health Effects and Routes of Exposure

Inhalation

May be harmful if inhaled. May cause respiratory tract irritation.

Ingestion

Harmful if swallowed.

Skin

Harmful if absorbed through skin. May cause skin irritation.

Eyes

May cause eye irritation.

L) Signs and Symptoms of Exposure

The most important known symptoms and effects are described in the labeling (see section 2.2) and/or in section 11.

To the best of our knowledge, the chemical, physical, and toxicological properties of this material have not been thoroughly investigated.

M) Additional Information

RTECS: PC0365000

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish:

LC50 - Lepomis macrochirus - 0.05 mg/l - 96 h

12.2 Persistance and Degradability

No data available.

12.3 Bioaccumulative Potential

No data available.

12.4 Mobility in Soil

No data available.

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Inhalation LC50: No data available. Dermal LD50: No data available.

12.5 Results of PBT and vPvB Assessment

No data available.

12.6 Other Adverse Effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste Treatment Methods

A) Product

Product may be burned in an incinerator equipped with afterburner and scrubber. Excess and expired materials are to be offered to a licensed hazardous material disposal company. Ensure that all Federal and Local regulations regarding the disposal and destruction of this material are followed.

B) Contaminated Packaging

Dispose of as above.

C) Other Considerations

Product is not to be disposed of in sanitary sewers, storm sewers, or landfills.

•	,			
14. TRANSPORT INFORMATION				
14.1 UN Number				
DOT (US): UN3077	IATA: UN3077	IMDG: UN3077	ADR/RID: UN3077	
14.2 UN Proper Shipping Name				
DOT (US)/IATA:				
Environmentally hazardous	substances, solid, n.o.s. (tra	ns-Chlordane)		
IMDG/ARD/RID:				
ENVIRONMENTALLY HAZA	ARDOUS SUBSTANCE, SO	LID, N.O.S. (trans-Chlordan	e)	
14.3 Transport Hazard Class(es				
DOT (US): 9	IATA: 9	IMDG: 9	ADR/RID: 9	
14.4 Packing Group				
DOT (US): III	IATA: III	IMDG: III	ADR/RID: III	
14.5 Environmental Hazards				
DOT (US): None	IATA: None	IMDG: Marine pollutant	ADR/RID: None	
14.6 Special Precautions for Us	er			
None				
15. REGULATORY INFORM	IATION			
This safety data sheet complies with the requirements of WHMIS (Canada), OSHA 1910.1200 (US), and EU Regulation				
EC No. 1907/2006 (European Union).				
15.1 Safety, Health and Environmental Regulations/Legislation Specific for the Substance or Mixture				
A) Canada				
DSL/NDSL Status: This product is not listed on the Canadian DSL/NDSL.				
B) United States				
TSCA Status: This product is not listed on the US EPA TSCA.				

C) European Union

ECHA Status: This product is not registered with the EU ECHA.

15.2 Chemical Safety Assessment

No data available

16. OTHER INFORMATION

16.1 Revision History

Original Publication Date: 9/15/2015

16.2 List of Abbreviations

- LD50 Median lethal dose of a substance required to kill 50% of a test population.
- LC50 Medial lethal concentration of a substance required to kill 50% of a test population.
- LDLo Lowest known lethal dose
- TDLo Lowest known toxic dose
- IARC International Agency for Research on Cancer
- NTP National Toxicology Program
- RTECS Registry of Toxic Effects of Chemical Substances

16.3 Further Information

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Toronto Research Chemicals - C327040Page 6This Safety Data Sheet contains 16 sections. All 16 sections must be present for this document to be valid.
believed to be correct to the best of our knowledge, but is to be only used as a guide. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated. Please take all due care when handling this product.





SAFETY DATA SHEET

SDS ID NO .: **Revision Date:** 0127MAR019 06/01/2016

1. IDENTIFICATION		
Product Name:	Marathon Petroleum Gasoline - All Grades	
Synonym: Chemical Family:	Gasoline; Regular Unleaded Gasoline; Conventional Regular Unleaded Gasoline; Mid Grade Unleaded Gasoline; Conventional Mid Grade Unleaded Gasoline; Premium Unleaded Gasoline; Conventional Premium Unleaded Gasoline; Sub-Octane Gasoline; Regular RBOB; Super RBOB; Premium RBOB; RBOB; Reformulated Blend Stock For Oxygenated Blending; 84 Octane Gasoline; CBOB; Premium CBOB; Conventional Blend Stock for Oxygenate Blending; Recreational Gasoline; Recreational Gasoline; Recreational Unleaded Gasoline; 89 Recreational Gasoline; Brand 89 Recreational Gasoline; 7.0 Max RVP 89 Recreational Gasoline; BR 7.0 Max RVP 89 Recreational Gasoline; 90 Recreational Gasoline; 91 Marina Gasoline; 90 Octane Midgrade Gasoline with No Ethanol; 0125MAR019; 0126MAR019; 0134MAR019; 0313MAR019; 0314MAR019 Complex Hydrocarbon Substance	
Recommended Use: Restrictions on Use:	Fuel. All others.	
Manufacturer, Importer, or Respons MARATHON PETROLEUM 539 South Main Street Findlay, OH 45840	ible Party Name and Address: COMPANY LP	
SDS information:	1-419-421-3070	
Emergency Telephone:	1-877-627-5463	

2. HAZARD IDENTIFI	CATION
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Classification

OSHA Regulatory Status This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 1
Skin corrosion/irritation	Category 2
Germ cell mutagenicity	Category 1B
Carcinogenicity	Category 1B
Reproductive toxicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Aspiration toxicity	Category 1
Acute aquatic toxicity	Category 2
Chronic aquatic toxicity	Category 2

Hazards Not Otherwise Classified (HNOC)

Label elements		
Danger		
EXTREMELY FLAMMABLE LIQUID AND VAPOR May accumulate electrostatic charge and ignite o May be fatal if swallowed and enters airways Causes skin irritation May cause respiratory irritation May cause drowsiness or dizziness May cause drowsiness or dizziness May cause genetic defects May cause cancer Suspected of damaging fertility or the unborn chil Toxic to aquatic life with long lasting effects	r explode	
Appearance Clear vellow liquid	Physical State Liquid	Odor Hydrocarbo

Keep container tightly closed

Ground/bond container and receiving equipment

Use explosion-proof electrical/ventilating/lighting/equipment

Use only non-sparking tools.

Take precautionary measures against static discharge

Avoid breathing mist/vapors/spray

Use only outdoors or in a well-ventilated area

Wear protective gloves/protective clothing/eye protection/face protection

Wash hands and any possibly exposed skin thoroughly after handling

Avoid release to the environment

Precautionary Statements - Response

IF exposed or concerned: Get medical attention IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower If skin irritation occurs: Get medical attention Wash contaminated clothing before reuse IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor if you feel unwell IF SWALLOWED: Immediately call a POISON CENTER or doctor Do NOT induce vomiting In case of fire: Use water spray, fog or regular foam for extinction Collect spillage

Precautionary Statements - Storage

Store in a well-ventilated place. Keep container tightly closed Keep cool Store locked up

Precautionary Statements - Disposal

Dispose of contents/container at an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Gasoline is a complex combination of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons having molecular chains ranging in length from four to ten carbons. May contain small amounts of dye and other additives (>0.02%) which are not considered hazardous at the concentrations used.

Composition Information:

Name	CAS Number	% Concentration
Gasoline	86290-81-5	100
Heptane (mixed isomers)	142-82-5	2.5-26
Pentane (mixed isomers)	78-78-4	6.5-19
Butane (mixed isomers)	106-97-8	0.5-14
Hexane Isomers (other than n-Hexane)	107-83-5	2-12
Toluene	108-88-3	3-9.5
Xylene (mixed isomers)	1330-20-7	3.5-9.5
n-Hexane	110-54-3	0.1-4.5
Cumene	98-82-8	0-4
1,2,4 Trimethylbenzene	95-63-6	1-4
Ethylbenzene	100-41-4	0.5-2.5
Benzene	71-43-2	0.1-1.5
Cyclohexane	110-82-7	0-1.5
Octane	111-65-9	0-1.5
1,2,3-trimethylbenzene	526-73-8	0-1
Naphthalene	91-20-3	0.1-0.5

All concentrations are percent by weight unless material is a gas. Gas concentrations are in percent by volume.

4. FIRST AID MEASURES

First Aid Measures	
General Advice:	In case of accident or if you feel unwell, seek medical advice immediately (show directions for use or safety data sheet if possible).
Inhalation:	Remove to fresh air. If not breathing, institute rescue breathing. If breathing is difficult, ensure airway is clear, give oxygen and continue to monitor. If heart has stopped, immediately begin cardiopulmonary resuscitation (CPR). Keep affected person warm and at rest. If symptoms occur get medical attention.
Skin Contact:	Immediately wash exposed skin with plenty of soap and water while removing contaminated clothing and shoes. May be absorbed through the skin in harmful amounts. Get medical attention if irritation persists. Any injection injury from high pressure equipment should be evaluated immediately by a physician as potentially serious (See NOTES TO PHYSICIAN).
	Place contaminated clothing in closed container until cleaned or discarded. If clothing is to be laundered, inform the person performing the operation of contaminant's hazardous properties. Destroy contaminated, non-chemical resistant footwear.
Eye Contact:	Flush immediately with large amounts of water for at least 15 minutes. Eyelids should be held away from the eyeball to ensure thorough rinsing. Gently remove contacts while flushing. Get medical attention if irritation persists.

Ingestion:	Do not induce vomiting because of danger of aspirating liquid into lungs, causing serious damage and chemical pneumonitis. If spontaneous vomiting occurs, keep head below hips, or if patient is lying down, turn body and head to side to prevent aspiration and monitor for breathing difficulty. Never give anything by mouth to an unconscious person. Keep affected person warm and at rest. GET IMMEDIATE MEDICAL ATTENTION.
Most important signs and symptom	s, both short-term and delayed with overexposure
Adverse Effects:	Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.
Indication of any immediate medica	l attention and special treatment needed
Notes To Physician:	INHALATION: This material (or a component) sensitizes the myocardium to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material. Administration of sympathomimetic drugs should be avoided.
	SKIN: Leaks or accidents involving high-pressure equipment may inject a stream of material through the skin and initially produce an injury that may not appear serious. Only a small puncture wound may appear on the skin surface but, without proper treatment and depending on the nature, original pressure, volume, and location of the injected material, can compromise blood supply to an affected body part. Prompt surgical debridement of the wound may be necessary to prevent irreversible loss of function and/or the affected body part. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES.
	INGESTION: This material represents a significant aspiration and chemical pneumonitis

hazard. Induction of emesis is not recommended.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

For small fires, Class B fire extinguishing media such as CO2, dry chemical, foam (AFFF/ATC) or water spray can be used. For large fires, water spray, fog or foam (AFFF/ATC) can be used. Firefighting should be attempted only by those who are adequately trained and equipped with proper protective equipment.

Unsuitable extinguishing media

Do not use straight water streams to avoid spreading fire.

Specific hazards arising from the chemical

This product has been determined to be an extremely flammable liquid per the OSHA Hazard Communication Standard and should be handled accordingly. May accumulate electrostatic charge and ignite or explode. Vapors may travel along the ground or be moved by ventilation and ignited by many sources such as pilot lights, sparks, electric motors, static discharge, or other ignition sources at locations distant from material handling. Flashback can occur along vapor trail. For additional fire related information, see NFPA 30 or the Emergency Response Guidebook 128.

Hazardous combustion products

Smoke, carbon monoxide, and other products of incomplete combustion.

Explosion data

Sensitivity to Mechanical Impact No. Sensitivity to Static Discharge Yes.

Special protective equipment and precautions for firefighters

Firefighters should wear full protective clothing and positive-pressure self-contained breathing apparatus (SCBA) with a full face-piece, as appropriate. Avoid using straight water streams. Water may be ineffective in extinguishing low flash point fires, but can be used to cool exposed surfaces. Avoid excessive water spray application. Water spray and foam (AFFF/ATC) must be applied carefully to avoid frothing and from as far a distance as possible. Keep run-off water out of sewers and water sources.

Additional firefighting tactics

FIRES INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after the fire is out. Do not direct water at source of leak or safety devices; icing may occur. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. For massive fire, use unmanned hose holders or monitor nozzles: if this is impossible, withdraw from area and let fire burn.

EVACUATION: Consider initial downwind evacuation for at least 1000 feet. If tank, rail car or tank truck is involved in a fire, ISOLATE for 5280 feet (1 mile) in all directions; also, consider initial evacuation of 5280 feet (1 mile) in all directions.

<u>NFPA</u>	Health 1	Flammability 3	Instability 0	Special Hazard -	
	6. <i>A</i>	ACCIDENTAL RELEAS	SE MEASURES	5	
Personal precautions:		Keep public away. Isolate and eva ignition sources.	cuate area. Shut off sou	urce if safe to do so. Eliminate all	
Protective equipment:		Use personal protection measures as recommended in Section 8.			
Emergency procedure	s:	Advise authorities and National Re entered a water course or sewer. I appropriate.	esponse Center (800-42 Notify local health and p	4-8802) if the product has ollution control agencies, if	
Environmental precaut	tions:	Avoid release to the environment. seperates in contact with water. M appropriate indicators.	Avoid subsoil penetratic onitor downstream for d	on. Ethanol in gasoline phase issolved ethanol or other	
Methods and materials containment:	s for	Contain liquid with sand or soil. Pr and open waterways.	event spilled material fro	om entering storm drains, sewers,	
Methods and materials up:	s for cleaning	Use suitable absorbent materials s liquids. Recover and return free pr ensure all equipment is grounded	such as vermiculite, san oduct to proper containe and bonded. Use only n	d, or clay to clean up residual ers. When recovering free liquids on-sparking tools.	
		7. HANDLING AND	STORAGE		

Product name: Marathon Petroleum Gasoline - All Grades SDS ID NO.: 0127MAR019

Safe Handling Precautions:	NEVER SIPHON THIS PRODUCT BY MOUTH. Use appropriate grounding and bonding practices. Static accumulating flammable liquid. Bonding and grounding may be insufficient to eliminate the hazard from static electricity. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. Vapors may travel along the ground or be moved by ventilation. Flashback may occur along vapor trails. No smoking. Use only non-sparking tools. Avoid contact with skin, eyes and clothing. Avoid breathing fumes, gas, or vapors. Use only with adequate ventilation. Avoid repeated and prolonged skin contact. Use personal protection measures as recommended in Section 8. Exercise good personal hygiene including removal of soiled clothing and prompt washing with soap and water. Do not cut, drill, grind or weld on empty containers since explosive residues may remain. Refer to applicable EPA, OSHA, NFPA and consistent state and local requirements.
	charged during mixing, filtering, pumping at high flow rates or loading and transfer operations. If this charge reaches a sufficiently high level, sparks can form that may ignite the vapors of flammable liquids. Sudden release of hot organic chemical vapors or mists from process equipment operating under elevated temperature and pressure, or sudden ingress of air into vacuum equipment may result in ignition of vapors or mists without the presence of obvious ignition sources. Nozzle spouts must be kept in contact with the containers or tank during the entire filling operation.
	Portable containers should never be filled while in or on a motor vehicle or marine craft. Containers should be placed on the ground. Static electric discharge can ignite fuel vapors when filling non-grounded containers or vehicles on trailers. The nozzle spout must be kept in contact with the container before and during the entire filling operation. Use only approved containers.
	A buildup of static electricity can occur upon re-entry into a vehicle during fueling especially in cold or dry climate conditions. The charge is generated by the action of dissimilar fabrics (i.e., clothing and upholstery) rubbing across each other as a person enters/exits the vehicle. A flash fire can result from this discharge if sufficient flammable vapors are present. Therefore, do not get back in your vehicle while refueling.
	Cellular phones and other electronic devices may have the potential to emit electrical charges (sparks). Sparks in potentially explosive atmospheres (including fueling areas such as gas stations) could cause an explosion if sufficient flammable vapors are present. Therefore, turn off cellular phones and other electronic devices when working in potentially explosive atmospheres or keep devices inside your vehicle during refueling.
	High-pressure injection of any material through the skin is a serious medical emergency even though the small entrance wound at the injection site may not initially appear serious. These injection injuries can occur from high-pressure equipment such as paint spray or grease or guns, fuel injectors, or pinhole leaks in hoses or hydraulic lines and should all be considered serious. High pressure injection injuries may be SERIOUS SURGICAL EMERGENCIES (See First Aid Section 4).
Storage Conditions:	Store in properly closed containers that are appropriately labeled and in a cool, well-ventilated area. Do not store near an open flame, heat or other sources of ignition.

Incompatible Materials

Strong oxidizing agents.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Name	ACGIH TLV	OSHA PELS:	OSHA - Vacated PELs	NIOSH IDLH
Gasoline 86290-81-5	300 ppm TWA 500 ppm STEL	-	300 ppm TWA 900 mg/m ³ TWA 500 ppm STEL 1500 mg/m ³ STEL	-

0127MAR019 Marathon Petroleum Gasoline - All Grades

Heptane (mixed isomers) 142-82-5	400 ppm TWA 500 ppm STEL	TWA: 500 ppm TWA: 2000 mg/m ³	400 ppm TWA 1600 mg/m ³ TWA 500 ppm STEL 2000 mg/m ³ STEL	750 ppm
Pentane (mixed isomers) 78-78-4	1000 ppm TWA	-	<u>-</u>	-
Butane (mixed isomers) 106-97-8	1000 ppm STEL	-	800 ppm TWA 1900 mg/m³ TWA	-
Hexane Isomers (other than n-Hexane) 107-83-5	500 ppm TWA 1000 ppm STEL	-	500 ppm TWA 1800 mg/m ³ TWA 1000 ppm STEL 3600 mg/m ³ STEL	-
Toluene 108-88-3	20 ppm TWA	TWA: 200 ppm Ceiling: 300 ppm	100 ppm TWA 375 mg/m³ TWA 150 ppm STEL 560 mg/m³ STEL	500 ppm
Xylene (mixed isomers) 1330-20-7	100 ppm TWA 150 ppm STEL	TWA: 100 ppm TWA: 435 mg/m³	100 ppm TWA 435 mg/m³ TWA 150 ppm STEL 655 mg/m³ STEL	900 ppm
n-Hexane 110-54-3	50 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 500 ppm TWA: 1800 mg/m ³	50 ppm TWA 180 mg/m³ TWA	1100 ppm
Cumene 98-82-8	50 ppm TWA	TWA: 50 ppm TWA: 245 mg/m ³ Skin	50 ppm TWA 245 mg/m³ TWA Limit applies to skin	900 ppm
1,2,4 Trimethylbenzene 95-63-6	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Ethylbenzene 100-41-4	20 ppm TWA	TWA: 100 ppm TWA: 435 mg/m ³	100 ppm TWA 435 mg/m³ TWA 125 ppm STEL 545 mg/m³ STEL	800 ppm
Benzene 71-43-2	0.5 ppm TWA 2.5 ppm STEL Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm (applies to industry segments exempt from the benzene standard) TWA: 1 ppm STEL: 5 ppm (see 29 CFR 1910.1028)	25 ppm Ceiling 1 ppm TWA 5 ppm STEL	500 ppm
Cyclohexane 110-82-7	100 ppm TWA	TWA: 300 ppm TWA: 1050 mg/m ³	300 ppm TWA 1050 mg/m³ TWA	1300 ppm
Octane 111-65-9	300 ppm TWA	TWA: 500 ppm TWA: 2350 mg/m ³	300 ppm TWA 1450 mg/m ³ TWA 375 ppm STEL 1800 mg/m ³ STEL	1000 ppm
1,2,3-trimethylbenzene 526-73-8	25 ppm TWA	-	25 ppm TWA 125 mg/m³ TWA	-
Naphthalene 91-20-3	10 ppm TWA Skin - potential significant contribution to overall exposure by the cutaneous route	TWA: 10 ppm TWA: 50 mg/m³	10 ppm TWA 50 mg/m³ TWA 15 ppm STEL 75 mg/m³ STEL	250 ppm
Notes:	The manufacturer 1989 air contamin were vacated in 1	has voluntarily elected to ants standard in its SDS 992.	o provide exposure limits s, even though certain o	s contained in OSHA's f those exposure limits
Engineering measures:	Local or general e ventilation. Use m	exhaust required in an en-	closed area or when the ipment that is explosion	re is inadequate -proof.
Personal protective equipmer	<u>nt</u>			

Eye protection:	Use goggles or face-shield if the potential for splashing exists.
Skin and body protection:	Use nitrile rubber, Viton® or PVA gloves for repeated or prolonged skin exposure. Glove suitability is based on workplace conditions and usage. Contact the glove manufacturer for specific advice on glove selection and breakthrough times.
Respiratory protection:	Use a NIOSH approved organic vapor chemical cartridge or supplied air respirators when there is the potential for airborne exposures to exceed permissible exposure limits or if excessive vapors are generated. Observe respirator assigned protection factors (APFs) criteria cited in federal OSHA 29 CFR 1910.134. Self-contained breathing apparatus should be used for fire fighting.
Hygiene measures:	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Liquid
Clear yellow liquid
Yellow
Hydrocarbon
No data available.

Property Values (Method) **Melting Point / Freezing Point** No data available. Initial Boiling Point / Boiling Range 24-210 °C / 75-410 °F (ASTM D86) **Flash Point** -43 °C / -45 °F **Evaporation Rate** No data available. Flammability (solid, gas) Not applicable. Flammability Limit in Air (%): Upper Flammability Limit: 7.6 Lower Flammability Limit: 1.4 **Explosion limits:** No data available. Vapor Pressure 5.5-15 psi (ASTM D4814) Vapor Density 3-4 **Specific Gravity / Relative Density** 0.70-0.76 No data available. Water Solubility Solubility in other solvents No data available. Partition Coefficient 2.13-4.5 **Decomposition temperature** No data available. pH: Not applicable Autoignition Temperature 280 °C / 536 °F **Kinematic Viscosity** No data available. Dynamic Viscosity No data available. **Explosive Properties** No data available. VOC Content (%) 100% Density No data available. **Bulk Density** Not applicable.

10. STABILITY AND REACTIVITY

Reactivity	The product is non-reactive under normal conditions.
Chemical stability	The material is stable at 70°F, 760 mmHg pressure.
Possibility of hazardous reactions	None under normal processing.
Hazardous polymerization	Will not occur.

Conditions to avoid

Incompatible Materials

Excessive heat, sources of ignition, open flame.

Strong oxidizing agents.

Hazardous decomposition products

None known under normal conditions of use.

11. TOXICOLOGICAL INFORMATION

Potential short-term adverse effects from overexposures

Inhalation	May cause irritation of respiratory tract. May cause drowsiness or dizziness. Breathing high concentrations of this material in a confined space or by intentional abuse can cause irregular heartbeats which can cause death.
Eye contact	Exposure to vapor or contact with liquid may cause mild eye irritation, including tearing, stinging, and redness.
Skin contact	Causes skin irritation. Effects may become more serious with repeated or prolonged contact. May be absorbed through the skin in harmful amounts.
Ingestion	May be fatal if swallowed or vomited and enters airways. May cause irritation of the mouth, throat and gastrointestinal tract.

Acute toxicological data

Name	Oral LD50	Dermal LD50	Inhalation LC50
Gasoline 86290-81-5	14000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.2 mg/L (Rat) 4 h
Heptane (mixed isomers) 142-82-5	-	3000 mg/kg (Rabbit)	103 g/m³ (Rat) 4 h
Pentane (mixed isomers) 78-78-4	-	-	450 mg/L (Mouse) 2 h
Butane (mixed isomers) 106-97-8	-	-	658 mg/L (Rat) 4 h
Hexane Isomers (other than n-Hexane) 107-83-5	> 5000 mg/kg (Rat)	-	-
Toluene 108-88-3	> 2000 mg/kg (Rat)	8390 mg/kg (Rabbit)	12.5 mg/L (Rat) 4 h
Xylene (mixed isomers) 1330-20-7	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 5.04 mg/L (Rat) 4 h
n-Hexane 110-54-3	15000 mg/kg (Rat)	3000 mg/kg (Rabbit)	48000 ppm (Rat) 4 h
Cumene 98-82-8	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 20 mg/L (Rat) 6 h
1,2,4 Trimethylbenzene 95-63-6	3280 mg/kg (Rat)	> 3160 mg/kg (Rabbit)	18,000 mg/m³ (Rat) 4 h
Ethylbenzene 100-41-4	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	17.2 mg/L (Rat) 4 h
Benzene 71-43-2	> 2000 mg/kg (Rat)	> 5000 mg/kg (Rabbit)	> 20 mg/l (Rat) 4 h
Cyclohexane 110-82-7	> 5000 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	13.9 mg/L (Rat) 4 h
Octane 111-65-9	-	-	118 g/m³ (Rat) 4 h
1,2,3-trimethylbenzene 526-73-8	-	-	-
Naphthalene 91-20-3	490 mg/kg (Rat)	> 2000 mg/kg (Rabbit)	> 340 mg/m³ (Rat) 1 h

Delayed and immediate effects as well as chronic effects from short and long-term exposure

NAPHTHAS: In a large epidemiological study on over 15,000 employees at several petroleum refineries and amongst residents located near these refineries, no increased risk of kidney cancer was observed in association with gasoline exposures (a similar material). In a similar study, no increased risk of kidney cancer was observed among petroleum refinery workers, but there was a slight trend in the incidence of kidney cancers among service station employees, especially after a 30-year latency period. Altered mental state, drowsiness, peripheral motor neuropathy, irreversible brain damage (so-called Petrol Sniffer's Encephalopathy), delirium, seizures, and sudden death have been reported from repeated overexposure to some hydrocarbon solvents, naphthas, and gasoline.

ISOPARAFFINS: Studies in laboratory animals have shown that long-term exposure to similar materials (isoparaffins) can cause kidney damage and kidney cancer in male laboratory rats. However, in-depth research indicates that these findings are unique to the male rat, and that these effects are not relevant to humans.

C9 AROMATIC HYDROCARBONS: A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm.

PENTANES: Studies of pentane isomers in laboratory animals indicate exposure to extremely high levels (roughly 10 vol.%) may induce cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

BUTANES: Studies in laboratory animals indicate exposure to extremely high levels of butanes (1-10 or higher vol.% in air) may cause cardiac arrhythmias (irregular heartbeats) which may be serious or fatal.

TOLUENE: Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Abuse of toluene at high concentrations (e.g., glue sniffing and solvent abuse) has been associated with adverse effects on the liver, kidney and nervous system, and can cause CNS depression, cardiac arrhythmias, and death. Studies of workers indicate longterm exposure may be related to impaired color vision and hearing. Some studies of workers suggest longterm exposure may be related to neurobehavioral and cognitive changes. Some of these effects have been observed in laboratory animals following repeated exposure to high levels of toluene. Several studies of workers suggest longterm exposure may be related to small increases in spontaneous abortions and changes in some gonadotropic hormones. However, the weight of evidence does not indicate toluene is a reproductive hazard to humans. Studies in laboratory animals indicate some changes in reproductive organs following high levels of exposure, but no significant effects on mating performance or reproduction were observed. Case studies of persons abusing toluene suggest isolated incidences of adverse effects on the fetus including birth defects. Findings in laboratory animals have been largely negative. Positive findings include small increases in minor skeletal and visceral malformations and developmental delays following very high levels of maternal exposure. Studies of workers indicate long-term exposure may be related to effects on the liver, kidney and blood, but these appear to be limited to changes in serum enzymes and decreased leukocyte counts. Adverse effects on the liver, kidney, thymus and nervous system were observed in animal studies following very high levels of exposure. The relevance of these findings to humans is not clear at this time.

XYLENES, ALL ISOMERS: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, nervous system damage and narcosis. Effects may be increased by the use of alcoholic beverages. Evidence of liver and kidney impairment were reported in workers recovering from a gross overexposure. Effects from Prolonged or Repeated Exposure: Impaired neurological function was reported

in workers exposed to solvents including xylene. Studies in laboratory animals have shown evidence of impaired hearing following high levels of exposure. Studies in laboratory animals suggest some changes in reproductive organs following high levels of exposure but no significant effects on reproduction were observed. Studies in laboratory animals indicate skeletal and visceral malformations, developmental delays, and increased fetal resorptions following extremely high levels of maternal exposure with evidence of maternal toxicity. The relevance of these observations to humans is not clear at this time. Adverse effects on the liver, kidney, bone marrow (changes in blood cell parameters) were observed in laboratory animals following high levels of exposure. The relevance of these observations to humans is not clear at this time.

1,2,4-TRIMETHYLBENZENE: The following information pertains to a mixture of C9 aromatic hydrocarbons, over 40% of which was composed of 1,2,4-trimethylbenzene. A developmental inhalation study was conducted in laboratory mice. Increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate were observed at the highest exposure level (1,500 ppm). This exposure level was extremely toxic to pregnant female mice (44% mortality). Reduced fetal body weights were also observed at 500 ppm. A multi-generation reproduction inhalation study was conducted in laboratory rats. Reductions in pup weights, pup weight gain, litter size, and pup survival were observed at 1,500 ppm, an exposure level at which significant maternal toxicity was observed. Reduced pup weight gain was also observed at 500 ppm. Embryotoxicity has been reported in studies of laboratory animals. Adverse effects included increased implantation losses, reduced fetal weights, delayed ossification and an increased incidence of cleft palate.<n>

N-HEXANE: Long-term or repeated exposure to n-hexane can cause peripheral nerve damage. Initial symptoms are numbness of the fingers and toes. Also, motor weakness can occur in the digits, but may also involve muscles of the arms, thighs and forearms. The onset of these symptoms may be delayed for several months to a year after the beginning of exposure. Testicular atrophy and partial to full loss of the germ cell line were observed in sub-chronic high-dose inhalation studies of laboratory rodents. These effects appeared irreversible. Rodent reproduction studies have shown evidence of reduced fetal weight but no frank malformations.

CUMENE: Overexposure to cumene may cause upper respiratory tract irritation and CNS depression. Studies in laboratory animals indicate evidence of respiratory tract hyperplasia, and adverse effects on the liver, kidney and adrenal glands following high level exposure. The relevance of these findings to humans is not clear at this time. Findings from lifetime laboratory rodent inhalation studies were as follows: In F344/N rats: an increased incidence of renal carcinomas and adenomas, respiratory epithelial adenomas, and interstitial cell adenomas of the testes. In B6C3F1 mice: an increased incidence of carcinomas and adenoma function and lung, liver neoplasms, hemangiosarcomas of the spleen, and adenomas of the thyroid.

ETHYLBENZENE: Findings from a 2-year inhalation study in rodents conducted by NTP were as follows: Effects were observed only at the highest exposure level (750 ppm). At this level the incidence of renal tumors was elevated in male rats (tubular carcinomas) and female rats (tubular adenomas). The incidence of tumors was also elevated in male mice (alveolar and bronchiolar carcinomas) and female mice (hepatocellular carcinomas). IARC has classified ethyl benzene as "possibly carcinogenic to humans" (Group 2B). Studies in laboratory animals indicate some evidence of post-implantation deaths following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure with evidence of maternal toxicity. The relevance of these findings to humans is not clear at this time. Studies in laboratory animals have demonstrated evidence of ototoxicity (hearing loss) following exposure levels as low as 300 ppm for 5 days. Studies in laboratory animals indicate some evidence of the protocol evidence of adverse effects on the liver, kidney, thyroid, and pituitary gland.

BENZENE: Studies of workers exposed to benzene show clear evidence that overexposure can cause cancer and other diseases of the blood forming organs including Acute

Myelogenous Leukemia (AML), and Aplastic Anemia (AA), an often fatal disease. Some studies suggest overexposure to benzene may also be associated with Myelodysplastic Syndrome (MDS). Findings from a case control study of workers exposed to benzene was reported during the 2009 Benzene Symposium in Munich included an increase in Acute Myeloid Leukemias and Non-Hodgkins Lymphoid Neoplasms (NHLN) of the subtype follicular lymphoma (FL) in some occupational categories. Some studies of workers exposed to benzene have shown an association with increased rates of chromosome aberrations in circulating lymphocytes. One study of women workers exposed to benzene suggested a weak association with irregular menstruation. However, other studies of workers exposed to benzene have not demonstrated clear evidence of an effect on fertility or reproductive outcome in humans. Benzene can cross the placenta and affect the developing fetus. Cases of AA have been reported in the offspring of persons severely overexposed to benzene. Studies in laboratory animals indicate that prolonged, repeated exposure to high levels of benzene vapor can cause bone marrow suppression and cancer in multiple organ systems. Studies in laboratory animals show evidence of adverse effects on male reproductive organs following high levels of exposure but no significant effects on reproduction have been observed. Embryotoxicity has been reported in studies of laboratory animals but effects were limited to reduced fetal weight and minor skeletal variations. Benzene has been classified as a proven human carcinogen by OSHA and a Group 1 (Carcinogenic to Humans) material by IARC. The current proposed IARC classification for benzene is summarized as follows: Sufficient evidence for Acute Myeloid Leukemia; limited evidence for Acute Lymphatic Leukemia, Chronic Lymphatic Leukemia, Non-Hodgkin Lymphoma, and Multiple Myeloma.

NAPHTHALENE: Severe jaundice, neurotoxicity (kernicterus) and fatalities have been reported in young children and infants as a result of hemolytic anemia from overexposure to naphthalene. Persons with glucose 6-phosphate dehydrogenase (G6PD) deficiency are more prone to the hemolytic effects of naphthalene. Adverse effects on the kidney have been reported in persons overexposed to naphthalene but these effects are believed to be a consequence of hemolytic anemia, and not a direct effect. Hemolytic anemia has been observed in laboratory animals exposed to naphthalene. Laboratory rodents exposed to naphthalene vapor for 2 years (lifetime studies) developed non-neoplastic and neoplastic tumors and inflammatory lesions of the nasal and respiratory tract. Cataracts and other adverse effects on the eye have been observed in laboratory animals exposed to high levels of naphthalene. Findings from a large number of bacterial and mammalian cell mutation assays have been negative. A few studies have shown chromosomal effects (elevated levels of Sister Chromatid Exchange or chromosomal aberrations) in vitro. Naphthalene has been classified as Possibly Carcinogenic to Humans (2B) by IARC, based on findings from studies in laboratory animals.

CARBON MONOXIDE: is a chemical asphyxiant with no warning properties (such as odor). At 400-500 ppm for 1 hour headache and dyspnea may occur. If activity is increased, symptoms of overexposure may include nausea, irritability, increased respiration, tinnitus, sweating, chest pain, confusion, impaired judgement, dizziness, weakness, drowsiness, ataxia, irregular heart beat, cyanosis and pallor. Levels in excess of 1000 ppm can result in collapse, loss of conciousness, respiratory failure and death. Extremely high concentrations (12,800 ppm) can cause immediate unconsciousness and death in 1-3 minutes. Repeated anoxia can lead to central nervous system damage and peripheral neuropathy, with loss of sensation in the fingers, amnesia, and mental deterioration and possible congestive heart failure. Damage may also occur to the fetus, lung, liver, kidney, spleen, cardiovascular system and other organs.

WHOLLY-VAPORIZED UNLEADED GASOLINE: Lifetime exposure to wholly vaporized unleaded gasoline produced an increased incidence of liver tumors in female mice exposed to the highest exposure concentration (2056 ppm) and α -2 urinary globulin-mediated kidney tumors in male rats. No exposure-related tumors were observed in male mice or female rats. The male-specific rat kidney tumors are not considered relevant to human health. Mice receiving lifetime repeated skin application of various petroleum naphthas exhibited an irritation-dependent increased incidence of skin tumors. Additional studies suggest that these tumors occur through a mechanism that may not be relevant to human health. Epidemiological data from over 18,000 petroleum marketing and distribution workers

	showed no increased risk of leukemia, multiple myeloma, or kidney cancer resulting from gasoline exposure. Unleaded gasoline has been identified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).
	COMBUSTION ENGINE EXHAUST: Chronic inhalation studies of gasoline engine exhaust in mice, rats and hamsters did not produce any carcinogenic effects. Condensates/extracts of gasoline engine exhaust produced an increase in tumors compared to controls when testing by skin painting, subcutaneous injection, intratracheal instillation or implantation into the lungs. Gasoline exhaust has been classified as possibly carcinogenic to humans (2B) by the International Agency for Research on Cancer (IARC).
Adverse effects related to the phys	ical, chemical and toxicological characteristics
Signs and Symptoms	Irritating to the skin and mucous membranes. Symptoms may include redness, itching, and inflammation. May cause nausea, vomiting, diarrhea, and signs of nervous system depression: headache, drowsiness, dizziness, loss of coordination, disorientation and fatigue. Aspiration hazard. May cause coughing, chest pains, shortness of breath, pulmonary edema and/or chemical pneumonitis. Repeated or prolonged skin contact may cause drying, reddening, itching and cracking.
Sensitization	Not expected to be a skin or respiratory sensitizer.
Mutagenic effects	May cause genetic defects.
Carcinogenicity	May cause cancer.

Cancer designations are listed in the table below

Name	ACGIH (Class)	IARC (Class)	NTP	OSHA
Gasoline 86290-81-5	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Not Listed	Not Listed
Heptane (mixed isomers) 142-82-5	Not Listed	Not Listed	Not Listed	Not Listed
Pentane (mixed isomers) 78-78-4	Not Listed	Not Listed	Not Listed	Not Listed
Butane (mixed isomers) 106-97-8	Not Listed	Not Listed	Not Listed	Not Listed
Hexane Isomers (other than n-Hexane) 107-83-5	Not Listed	Not Listed	Not Listed	Not Listed
Toluene 108-88-3	Not Classifiable (A4)	Not Classifiable (3)	Not Listed	Not Listed
Xylene (mixed isomers) 1330-20-7	Not classifiable (A4)	Not classifiable (3)	Not Listed	Not Listed
n-Hexane 110-54-3	Not Listed	Not Listed	Not Listed	Not Listed
Cumene 98-82-8	Not listed	Possible human carcinogen (2B)	Reasonably anticipated to be a human carcinogen	Not listed
1,2,4 Trimethylbenzene 95-63-6	Not Listed	Not Listed	Not Listed	Not Listed
Ethylbenzene 100-41-4	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Not Listed	Not Listed
Benzene 71-43-2	Confirmed human carcinogen (A1)	Carcinogenic to humans (1)	Known to be human carcinogen	Known carcinogen
Cyclohexane 110-82-7	Not Listed	Not Listed	Not Listed	Not Listed
Octane 111-65-9	Not Listed	Not Listed	Not Listed	Not Listed
1,2,3-trimethylbenzene 526-73-8	Not Listed	Not Listed	Not Listed	Not Listed
Naphthalene 91-20-3	Confirmed animal carcinogen (A3)	Possible human carcinogen (2B)	Reasonably anticipated to be a human carcinogen	Not Listed

Reproductive toxicity

Suspected of damaging fertility or the unborn child.

Specific Target Organ Toxicity (STOT) - single exposure

Respiratory system. Central nervous system.

Specific Target Organ Toxicity (STOT) - repeated exposure

Not classified.

Aspiration hazard

May be fatal if swallowed or vomited and enters airways.

12. ECOLOGICAL INFORMATION

Ecotoxicity

This product should be considered toxic to aquatic organisms, with the potential to cause long lasting adverse effects in the aquatic environment.

Name	Algae/aquatic plants	Fish	Toxicity to Microorganisms	Crustacea
Gasoline 86290-81-5	72-hr EC50 = 56 mg/l Algae	96-hr LC50 = 11 mg/l Rainbow trout (static)	-	48-hr LC50 = 7.6 mg/l Daphnia magna
Heptane (mixed isomers) 142-82-5	_	96-hr LC50 = 375 mg/L Tilapia	-	-
Pentane (mixed isomers) 78-78-4	-	96-hr LC50 = 3.1 mg/L Rainbow trout	-	48-hr EC50 = >1 - <10 mg/L Daphnia magna
Butane (mixed isomers) 106-97-8	-	-	-	-
Hexane Isomers (other than n-Hexane) 107-83-5	-	-	-	-
Toluene 108-88-3	72-hr EC50 = 12.5 mg/l Algae	96-hr LC50 <= 10 mg/l Rainbow trout	-	48-hr EC50 = 5.46-9.83 mg/l Daphnia magna 48-hr EC50 = 11.5 mg/l Daphnia magna (Static)
Xylene (mixed isomers) 1330-20-7	72-hr EC50 = 11 mg/l Algae	96-hr LC50 = 8 mg/l Rainbow trout	-	48-hr LC50 = 3.82 mg/l Daphnia magna
n-Hexane 110-54-3	_	96-hr LC50 = 2.5 mg/l Fathead minnow	-	-
Cumene 98-82-8	72-hr EC50 = 2.6 mg/l Algae	96-hr LC50 = 6.04-6.61 mg/l Fathead minnow (Flow-through) 96-hr LC50 = 2.7 mg/l Rainbow trout (semi-static)	-	48-hr EC50 = 7.9-14.1 mg/l Daphnia magna (static)
1,2,4 Trimethylbenzene 95-63-6	-	96-hr LC50 = 7.19-8.28 mg/l Fathead minnow (flow-through)	-	48-hr EC50 = 6.14 mg/L Daphnia magna
Ethylbenzene 100-41-4	72-hr EC50 = 1.7-7.6 mg/l Algae	96-hr LC50 = 4 mg/L Rainbow trout	-	48-hr EC50 = 1-4 mg/L Daphnia magna
Benzene 71-43-2	72-hr EC50 = 29 mg/l Algae	96-hr LC50 = 5.3 mg/l Rainbow trout (flow-through)	-	48-hr EC50 = 8.76-15.6 mg/l Daphnia magna (Static)
Cyclohexane 110-82-7	72-hr EC50 = 500 mg/l Algae	96-hr LC50 = 3.96-5.18 mg/l Fathead minnow	-	48-hr EC50 = 1.7-3.5 mg/L Bay shrimp
Octane 111-65-9	-	-	-	48-hr LC50 = 0.38 mg/l Daphnia magna
1,2,3-trimethylbenzene 526-73-8	-	96-hr LC50 = 7.72 mg/l Fathead Minnow (flow-through)	-	-
Naphthalene 91-20-3	-	96-hr LC50 = 0.91-2.82 mg/l Rainbow trout (static) 96-hr LC50 = 1.99 mg/l Fathead minnow (static)		48-hr LC50 = 1.6 mg/l Daphnia magna

Persistence and degradability

Expected to be inherently biodegradable. The presence of ethanol in this product may impede the biodegradation of benzene, toluene, ethylbenzene and xylene in groundwater, resulting in elongated plumes of these constituents.

Bioaccumulation	Has the potential to bioaccumulate.

Mobility in soil May partition into air, soil and water.

Other adverse effects No information available.

13. DISPOSAL CONSIDERATIONS

Description of Waste Residues

This material may be a flammable liquid waste.

Safe Handling of Wastes

Handle in accordance with applicable local, state, and federal regulations. Use personal protection measures as required. Use appropriate grounding and bonding practices. Use only non-sparking tools. Do not expose to heat, open flames, strong oxidizers or other sources of ignition. No smoking.

Disposal of Wastes / Methods of Disposal

The user is responsible for determining if any discarded material is a hazardous waste (40 CFR 262.11). Dispose of in accordance with federal, state and local regulations.

Methods of Contaminated Packaging Disposal

Empty containers should be completely drained and then discarded or recycled, if possible. Do not cut, drill, grind or weld on empty containers since explosive residues may be present. Dispose of in accordance with federal, state and local regulations.

14. TRANSPORT INFORMATION

DOT (49 CFR 172.101): UN Proper Shipping Name: UN/Identification No: Transport Hazard Class(es): Packing Group:	Gasoline UN 1203 3 II
TDG (Canada): UN Proper Shipping Name: UN/Identification No: Transport Hazard Class(es): Packing Group:	Gasoline UN 1203 3 II

15. REGULATORY INFORMATION

US Federal Regulatory Information:

US TSCA Chemical Inventory Section 8(b):

This product and/or its components are listed on the TSCA Chemical Inventory.

EPA Superfund Amendment & Reauthorization Act (SARA):

SARA Section 302: This product does not contain any component(s) included on EPA's Extremely Hazardous Substance (EHS) List.

Name	CERCLA/SARA - Section 302 Extremely Hazardous Substances and TPQs
Gasoline	NA
Heptane (mixed isomers)	NA
Pentane (mixed isomers)	NA
Butane (mixed isomers)	NA
Hexane Isomers (other than n-Hexane)	NA
Toluene	NA
Xylene (mixed isomers)	NA

0127MAR019 Marathon Petroleum Gasoline - All Grades

n-Hexane	NA
Cumene	NA
1,2,4 Trimethylbenzene	NA
Ethylbenzene	NA
Benzene	NA
Cyclohexane	NA
Octane	NA
1,2,3-trimethylbenzene	NA
Naphthalene	NA

SARA Section 304:

This product may contain component(s) identified either as an EHS or a CERCLA Hazardous substance which in case of a spill or release may be subject to SARA reporting requirements:

Name	Hazardous Substances RQs
Gasoline	NA
Heptane (mixed isomers)	NA
Pentane (mixed isomers)	NA
Butane (mixed isomers)	NA
Hexane Isomers (other than n-Hexane)	NA
Toluene	1000 lb final RQ 454 kg final RQ
Xylene (mixed isomers)	100 lb final RQ 45.4 kg final RQ
n-Hexane	5000 lb final RQ 2270 kg final RQ
Cumene	5000 lb final RQ 2270 kg final RQ
1,2,4 Trimethylbenzene	NA
Ethylbenzene	1000 lb final RQ 454 kg final RQ
Benzene	10 lb final RQ 4.54 kg final RQ
Cyclohexane	1000 lb final RQ 454 kg final RQ
Octane	NA
1,2,3-trimethylbenzene	NA
Naphthalene	100 lb final RQ 45.4 kg final RQ

SARA:

The following EPA hazard categories apply to this product:

Acute Health Hazard Chronic Health Hazard Fire Hazard

SARA Section 313:

This product may contain component(s), which if in exceedance of the de minimus threshold, may be subject to the reporting requirements of SARA Title III Section 313 Toxic Release Reporting (Form R).

Name	CERCLA/SARA 313 Emission reporting:
Gasoline	None
Heptane (mixed isomers)	None
Pentane (mixed isomers)	None
Butane (mixed isomers)	None
Hexane Isomers (other than n-Hexane)	None
Toluene	1.0 % de minimis concentration
Xylene (mixed isomers)	1.0 % de minimis concentration
n-Hexane	1.0 % de minimis concentration
Cumene	1.0 % de minimis concentration

1,2,4 Trimethylbenzene	1.0 % de minimis concentration
Ethylbenzene	0.1 % de minimis concentration
Benzene	0.1 % de minimis concentration
Cyclohexane	1.0 % de minimis concentration
Octane	None
1,2,3-trimethylbenzene	None
Naphthalene	0.1 % de minimis concentration

State and Community Right-To-Know Regulations: The following component(s) of this material are identified on the regulatory lists below:

Gasoline	
Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 0957
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Not Listed
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous	Not Listed
Substances:	
New Jersey - Special Hazardous Substances:	Carcinogen; Flammable - third degree
New Jersey - Environmental Hazardous	SN 0957 TPQ: 10000 lb (Under N.J.A.C. 7:1G, environmental
Substances List:	hazardous substances in mixtures such as gasoline or new and
	used petroleum oil may be reported under these categories)
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 -	Not Listed
List of Hazardous Substances:	
Heptane (mixed isomers)	
Louisiana Right-To-Know:	Not Listed
California Proposition 65:	NOT LISTED
New Jersey Right To Know.	SIN 1339 Dresent
Massachusotte Pight To Know:	Present
Elorida Substance List:	Not Listed
Plotud Substance List. Phode Island Pight-To-Know:	Tovic: Elammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous	Not Listed
Substances:	
New Jersey - Special Hazardous Substances:	Flammable - third degree
New Jersey - Environmental Hazardous	Not Listed
Substances List:	
Illinois - Toxic Air Contaminants:	Not Listed
New York - Reporting of Releases Part 597 -	Not Listed
List of Hazardous Substances:	
Pentane (mixed isomers)	
Louisiana Right-To-Know:	Not Listed
California Proposition 65:	Not Listed
New Jersey Right-To-Know:	SN 1064
Pennsylvania Right-To-Know:	Present
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Knode Island Right-To-Know:	Not Listed
Managahuratta Extraordingsitu Useradaya Outar	
massachusetts extraordinarily Hazardous Substances:	NOL LISTED

California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Butane (mixed isomers) Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Hexane Isomers (other than n-Hexane) Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Toluene Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances:

Not Listed Not Listed Flammable - fourth degree SN 1064 TPQ: 500 lb Not Listed Not Listed Not Listed Not Listed SN 0273 Present Present Not Listed Toxic: Flammable Not Listed Not Listed Not Listed Not Listed Flammable - fourth degree SN 0273 TPQ: 500 lb Not Listed Not Listed Not Listed Not Listed SN 1285 Present Present Not Listed Not Listed Not Listed Not Listed Not Listed Not Listed Flammable - third degree Not Listed Not Listed Not Listed Not Listed Developmental toxicity, initial date 1/1/91 Female reproductive toxicity, initial date 8/7/09 SN 1866 Environmental hazard Present Not Listed Toxic (skin); Flammable (skin) 100 lb Annual usage threshold Not Listed Not Listed Not Listed

New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Xylene (mixed isomers) Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: n-Hexane Louisiana Right-To-Know: California Proposition 65: New Jersev Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Cumene Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants:

Flammable - third degree; Teratogen SN 1866 TPQ: 500 lb Present 1000 lb RQ (air); 1 lb RQ (land/water) Not Listed Not Listed SN 2014 Environmental hazard Present Not Listed Toxic (skin); Flammable (skin) 100 lb Annual usage threshold all isomers Not Listed Not Listed Not Listed Flammable - third degree SN 2014 TPQ: 500 lb Present 1000 lb RQ (air); 1 lb RQ (land/water) Not Listed Not Listed SN 1340 Present Present Not Listed Toxic; Flammable Not Listed Not Listed Not Listed Not Listed Flammable - third degree SN 1340 TPQ: 500 lb Present 1 lb RQ (air); 1 lb RQ (land/water) Not Listed Carcinogen, initial date 4/6/10 SN 0542 Environmental hazard Present Not Listed Toxic (skin); Flammable (skin) Not Listed Not Listed Not Listed Not Listed Flammable - third degree SN 0542 TPQ: 500 lb

Present

New York - Reporting of Releases Part 597 -List of Hazardous Substances: 1,2,4 Trimethylbenzene Louisiana Right-To-Know: Not Listed California Proposition 65: Not Listed New Jersey Right-To-Know: SN 1929 Pennsylvania Right-To-Know: Present Massachusetts Right-To Know: Present Florida Substance List: Rhode Island Right-To-Know: Toxic Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: Present New York - Reporting of Releases Part 597 -List of Hazardous Substances: Ethylbenzene Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: SN 0851 Pennsylvania Right-To-Know: Massachusetts Right-To Know: Present Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Not Listed Massachusetts Extraordinarily Hazardous Substances: Not Listed California - Regulated Carcinogens: Not Listed Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: Present New York - Reporting of Releases Part 597 -List of Hazardous Substances: Benzene Louisiana Right-To-Know: California Proposition 65: SN 0197 New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Present Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: Present New York - Reporting of Releases Part 597 -

Not Listed Carcinogen, initial date 6/11/04 Environmental hazard Not Listed Toxic; Flammable Not Listed Carcinogen; flammable - Third degree SN 0851 TPQ: 500 lb 1000 lb RQ (air); 1 lb RQ (land/water) Not Listed Carcinogen, initial date 2/27/87 Developmental toxicity, initial date 12/26/97 Male reproductive toxicity, initial date 12/26/97 Environmental hazard; Special hazardous substance Carcinogen; Extraordinarily hazardous Not Listed Toxic (skin); Flammable (skin); Carcinogen (skin) 100 lb Annual usage threshold Carcinogen; Extraordinarily hazardous Not Listed Carcinogen; Flammable - third degree; Mutagen SN 0197 TPQ: 500 lb

Present 10 lb RQ (air); 1 lb RQ (land/water)

List of Hazardous Substances:

Cyclohexane Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Octane Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: 1,2,3-trimethylbenzene Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know: Pennsylvania Right-To-Know: Massachusetts Right-To Know: Florida Substance List: Rhode Island Right-To-Know: Michigan Critical Materials Register List: Massachusetts Extraordinarily Hazardous Substances: California - Regulated Carcinogens: Pennsylvania RTK - Special Hazardous Substances: New Jersey - Special Hazardous Substances: New Jersey - Environmental Hazardous Substances List: Illinois - Toxic Air Contaminants: New York - Reporting of Releases Part 597 -List of Hazardous Substances: Naphthalene Louisiana Right-To-Know: California Proposition 65: New Jersey Right-To-Know:

Not Listed Not Listed SN 0565 Environmental hazard Present Not Listed Toxic; Flammable Not Listed Not Listed Not Listed Not Listed Flammable - third degree SN 0565 TPQ: 500 lb Not Listed 1000 lb RQ (air); 1 lb RQ (land/water) Not Listed Not Listed SN 1434 Present Present Not Listed Toxic: Flammable Not Listed Not Listed Not Listed Not Listed Flammable - third degree Not Listed Not Listed Not Listed Not Listed Not Listed SN 1929 Present Present Not Listed Toxic Not Listed Not Listed Not Listed Not Listed Not Listed Not Listed Present Not Listed Not Listed

Carcinogen, initial date 4/19/02 SN 1322 SN 3758

Pennsylvania Right-To-Know:	Environmental hazard Present (particulate)
Massachusetts Right-To Know:	Present
Florida Substance List:	Not Listed
Rhode Island Right-To-Know:	Toxic; Flammable
Michigan Critical Materials Register List:	Not Listed
Massachusetts Extraordinarily Hazardous Substances:	Not Listed
California - Regulated Carcinogens:	Not Listed
Pennsylvania RTK - Special Hazardous	Not Listed
Substances:	
New Jersey - Special Hazardous Substances:	Carcinogen
New Jersey - Environmental Hazardous	SN 1322 TPQ: 500 lb (Reportable at the de minimis quantity of
Substances List:	>0.1%)
Illinois - Toxic Air Contaminants:	Present
New York - Reporting of Releases Part 597 -	100 lb RQ (air); 1 lb RQ (land/water)
List of Hazardous Substances:	

Canada DSL/NDSL Inventory: This

This product and/or its components are listed either on the Domestic Substances List (DSL) or are exempt.

Canadian Regulatory Information:

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the (M)SDS contains all the information required by the Controlled Products Regulations.

Name	Canada - WHMIS: Classifications of Substances:	Canada - WHMIS: Ingredient Disclosure:
Gasoline	B2,D2A,D2B	0.1%
Heptane (mixed isomers)	B2,D2B	1%
Pentane (mixed isomers)	B2	1%
Butane (mixed isomers)	A,B1	1%
Hexane Isomers (other than n-Hexane)	B2	1%
Toluene	B2,D2A,D2B	0.1%
Xylene (mixed isomers)	B2,D2A,D2B	m-, o-isomers 1.0%; p-isomer 0.1%
n-Hexane	B2,D2A,D2B	1%
Cumene	B2,D2A	0.1%
1,2,4 Trimethylbenzene	B3,D2B	1%
Ethylbenzene	B2,D2A,D2B	0.1%
Benzene	B2,D2A,D2B	0.1%
Cyclohexane	B2,D2B	1%
Octane	B2,D2B	1%
1,2,3-trimethylbenzene	B3	1%
Naphthalene	B4,D2A	0.1%



Note:

Not applicable.

16. OTHER INFORMATION

Prepared By

Toxicology and Product Safety

Revision Date:

Toxicology and Troduct Ca

Revision Note:

06/01/2016

Revised Sections	The following sections (§) have been updated:	
	3. COMPOSITION/INFORMATION ON INGREDIENTS	
	4. FIRST AID MEASURES	
	6. ACCIDENTAL RELEASE MEASURES	
	7. HANDLING AND STORAGE	
	8. EXPOSURE CONTROLS/PERSONAL PROTECTION	
	9. PHYSICAL AND CHEMICAL PROPERTIES	
	11. TOXICOLOGICAL INFORMATION	
	12. ECOLOGICAL INFORMATION	
	15. REGULATORY INFORMATION	

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information is intended as guidance for safe handling, use, processing, storage, transportation, accidental release, clean-up and disposal and is not considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SAFETY DATA SHEET

Helium

Section 1. Identification

GHS product identifier Chemical name	:	Helium Helium
Other means of identification	:	helium (dot); Helium-4; He; o-Helium; UN 1046
Product use	:	Synthetic/Analytical chemistry.
Synonym SDS #	:	helium (dot); Helium-4; He; o-Helium; UN 1046 001025
Supplier's details	:	Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Emergency telephone	:	1-866-734-3438

number (with hours of operation)

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	: GASES UNDER PRESSURE - Compressed gas
GHS label elements	
Hazard pictograms	
Signal word	: Warning
Hazard statements	: Contains gas under pressure; may explode if heated. May displace oxygen and cause rapid suffocation.
Precautionary statements	
General	: Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction.
Prevention	: Use and store only outdoors or in a well ventilated place.
Response	: Not applicable.
Storage	 Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.
Disposal	: Not applicable.
Hazards not otherwise classified	: In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.



Section 3. Composition/information on ingredients

Substance/mixture Chemical name Other means of identification

: Substance

- : Helium
- : helium (dot); Helium-4; He; o-Helium; UN 1046

CAS number/other identifiers

CAS number	: 7440-59-7
Product code	: 001025

Ingredient name	%	CAS number
Helium	100	7440-59-7

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: As this product is a gas, refer to the inhalation section.

Most important symptoms	effects, acute and delayed	
Potential acute health eff	<u>ects</u>	
Eye contact	: Contact with rapidly expanding gas may cause burns or frostbite.	
Inhalation	: No known significant effects or critical hazards.	
Skin contact	: Contact with rapidly expanding gas may cause burns or frostbite.	
Frostbite	: Try to warm up the frozen tissues and seek medical attention.	
Ingestion	: As this product is a gas, refer to the inhalation section.	
<u>Over-exposure signs/syn</u>	<u>ptoms</u>	
Eye contact	: No specific data.	
Inhalation	: No specific data.	
Skin contact	: No specific data.	
Ingestion	: No specific data.	
Indication of immediate me	edical attention and special treatment needed, if necessary	
Notes to physician	 Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled. 	
Date of issue/Date of revision	: 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 2	/11

Large spill

Section 4. First aid measures

Specific treatments Protection of first-aiders : No specific treatment.

: No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures **Extinguishing media** Suitable extinguishing : Use an extinguishing agent suitable for the surrounding fire. media Unsuitable extinguishing : None known. media Specific hazards arising : Contains gas under pressure. In a fire or if heated, a pressure increase will occur and the container may burst or explode. from the chemical Hazardous thermal : No specific data. decomposition products Special protective actions : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable for fire-fighters training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. Fire-fighters should wear appropriate protective equipment and self-contained breathing **Special protective** ŝ, apparatus (SCBA) with a full face-piece operated in positive pressure mode. equipment for fire-fighters

Section 6. Accidental release measures

Personal precautions, protect	<u>tiv</u>	e equipment and emergency procedures
For non-emergency personnel	:	No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.
For emergency responders	:	If specialised clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".
Environmental precautions	:	Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).
Methods and materials for co	nt	ainment and cleaning up
Small spill	:	Immediately contact emergency personnel. Stop leak if without risk.

: Immediately contact emergency personnel. Stop leak if without risk. Note: see Section

1 for emergency contact information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling					
Protective measures	:	Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid contact with eyes, skin and clothing. Avoid breathing gas. Empty containers retain product residue and can be hazardous. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.			
Advice on general occupational hygiene	:	Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.			
Conditions for safe storage, including any incompatibilities	:	Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Keep container tightly closed and sealed until ready for use. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).			

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits		
Helium	Oxygen Depletion [Asphyxiant]		

Appropriate engineering controls	: Good general ventilation should be sufficient to control worker exposure to airborne contaminants.
Environmental exposure controls	: Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.
Individual protection measu	res
Hygiene measures	: Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.
Eye/face protection	: Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Date of issue/Date of revision : 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 4	Date of issue/Date of revision	: 10/15/2014.	Date of previous issue	: 10/2/2014.	Version	:0.02	4/11
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Section 8. Exposure controls/personal protection

Hand protection	: Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
Body protection	: Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Other skin protection	: Appropriate footwear and any additional skin protection measures should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.
Respiratory protection	: Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

Section 9. Physical and chemical properties

<u>Appearance</u>			
Physical state	: Gas. [Compressed gas.]		
Color	: Colorless.		
Molecular weight	: 4 g/mole		
Molecular formula	: He		
Boiling/condensation point	: -268.9°C (-452°F)		
Melting/freezing point	: -272.2°C (-458°F)		
Critical temperature	: -267.9°C (-450.2°F)		
Odor	: Odorless.		
Odor threshold	: Not available.		
рН	: Not available.		
Flash point	: [Product does not sustain combustion.]		
Burning time	: Not applicable.		
Burning rate	: Not applicable.		
Evaporation rate	: Not available.		
Flammability (solid, gas)	: Not available.		
Lower and upper explosive (flammable) limits	: Not available.		
Vapor pressure	: Not available.		
Vapor density	: 0.14 (Air = 1) Liquid Density@BP: 7.8 lb/ft3 (125 kg/m3)		
Specific Volume (ft ³ /lb)	: 96.1538		
Gas Density (lb/ft ³)	: 0.0104		
Relative density	: Not applicable.		
Solubility	: Not available.		
Solubility in water	: Not available.		
Partition coefficient: n- octanol/water	: 0.28		
Auto-ignition temperature	: Not available.		
Decomposition temperature	: Not available.		
Date of issue/Date of revision	: 10/15/2014. Date of previous issue : 10/2/2014.	Version : 0.02	5/11

Date of issue/Date of revision

Section 9. Physical and chemical properties

SADT Viscosity : Not available. : Not applicable.

Section 10. Stability and reactivity

Reactivity	: No specific test data related to reactivity available for this product or its ingredients.
Chemical stability	: The product is stable.
Possibility of hazardous reactions	: Under normal conditions of storage and use, hazardous reactions will not occur.
Conditions to avoid	: No specific data.
Hazardous decomposition products	: Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Not available.

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Date of issue/Date of revision

: 10/15/2014. Date of previous issue

us issue : 10/2/2

Section 11. Toxicological information

Information on the likely routes of exposure	:	Not available.					
Potential acute health effects							
Eye contact	: Contact with rapidly expanding gas may cause burns or frostbite.						
Inhalation	1	No known significant effects or critical hazards.					
Skin contact	1	Contact with rapidly expanding gas may cause burns or frostbite.					
Ingestion	:	As this product is a gas, refer to the inhalation section.					
Symptoms related to the physical	sic	al, chemical and toxicological characteristics					
Eye contact	1	No specific data.					
Inhalation	:	No specific data.					
Skin contact	1	No specific data.					
Ingestion	:	No specific data.					
Delayed and immediate effect	ts :	and also chronic effects from short and long term exposure					
<u>Short term exposure</u>							
Potential immediate effects	:	Not available.					
Potential delayed effects	1	Not available.					
<u>Long term exposure</u>							
Potential immediate effects	:	Not available.					
Potential delayed effects	:	Not available.					
Potential chronic health effe	ct	<u>S</u>					
Not available.							
General	:	No known significant effects or critical hazards.					
Carcinogenicity	:	No known significant effects or critical hazards.					
Mutagenicity	1	No known significant effects or critical hazards.					
Teratogenicity	1	No known significant effects or critical hazards.					
Developmental effects	1	No known significant effects or critical hazards.					
Fertility effects	:	No known significant effects or critical hazards.					
Numerical measures of toxici	<u>ty</u>						
• • • • • • • • •							

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Date of issue/Date of revision

: 10/15/2014. Date of previous issue

us issue : 10/2/2014.

Section 12. Ecological information

Bioaccumulative potential

Product/ingredient name	LogPow	BCF	Potential
Helium	0.28	-	low

Mobility in soil

Soil/water partition	: Not available.
coefficient (Koc)	

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

- **Disposal methods**
- : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	ΙΑΤΑ
UN number	UN1046	UN1046	UN1046	UN1046	UN1046
UN proper shipping name	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED	HELIUM, COMPRESSED
Transport hazard class(es)	2.2	2.2	2.2	2.2	2.2
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	Limited quantity Yes. Packaging instruction Passenger aircraft Quantity limitation: 75 kg Cargo aircraft Quantity limitation: 150 kg	Explosive Limit and Limited Quantity Index 0.125 Passenger Carrying Road or Rail Index 75	-	-	Passenger and Cargo <u>Aircraft</u> Quantity limitation: 75 kg <u>Cargo Aircraft Only</u> Quantity limitation: 150 kg

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 14. Transport information

Special precautions for user	1	Transport within user's premises: always transport in closed containers that are
		upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according : Not available. to Annex II of MARPOL 73/78 and the IBC Code

Section 15. Regulatory information

•		
U.S. Federal regulations	: TSCA 8	(a) CDR Exempt/Partial exemption: Not determined
	United \$	States inventory (TSCA 8b): This material is listed or exempted.
Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs)	: Not liste	d
Clean Air Act Section 602 Class I Substances	: Not liste	d
Clean Air Act Section 602 Class II Substances	: Not liste	d
DEA List I Chemicals (Precursor Chemicals)	: Not liste	d
DEA List II Chemicals (Essential Chemicals)	: Not liste	d
SARA 302/304 Composition/information	<u>ingredier</u>	<u>nts</u>
No products were found.		
SARA 304 RQ	: Not appl	licable.
<u>SARA 311/312</u>		
Classification	Sudden	release of pressure
Composition/information	ingredier	nts

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Helium	100	No.	Yes.	No.	No.	No.

State regulations Massachusetts

- : This material is listed.
- **New York**
- : This material is not listed.
- **New Jersey**
- : This material is listed.
- Pennsylvania
- : This material is listed.
- **Canada inventory**
- International regulations
- : This material is listed or exempted.

: 10/2/2014.

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Section 15. Regulatory information

International lists	: Australia inventory (AICS): This material is listed or exempted.
	China inventory (IECSC): This material is listed or exempted.
	Japan inventory: Not determined.
	Korea inventory: This material is listed or exempted.
	Malaysia Inventory (EHS Register): Not determined.
	New Zealand Inventory of Chemicals (NZIoC): This material is listed or exempted.
	Philippines inventory (PICCS): This material is listed or exempted.
	Taiwan inventory (CSNN): Not determined.
Chemical Weapons	: Not listed
Convention List Schedule	
I Chemicals	
Chemical Weapons	: Not listed
Convention List Schedule	
II Chemicals	
Chemical Weapons	: Not listed
Convention List Schedule	
III Chemicals	
<u>Canada</u>	
WHMIS (Canada)	: Class A: Compressed gas.
	CEPA Toxic substances: This material is not listed.
	Canadian ARET: This material is not listed.

Canadian NPRI: This material is not listed. Alberta Designated Substances: This material is not listed. Ontario Designated Substances: This material is not listed. Quebec Designated Substances: This material is not listed.

Section 16. Other information

Canada Label requirements : Class A: Compressed gas.

Hazardous Material Information System (U.S.A.)



Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks Although HMIS® ratings are not required on SDSs under 29 CFR 1910. 1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered mark of the National Paint & Coatings Association (NPCA). HMIS® materials may be purchased exclusively from J. J. Keller (800) 327-6868.

The customer is responsible for determining the PPE code for this material.

National Fire Protection Association (U.S.A.)



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Date of issue/Date of revision : 10/15/2014. Date of previous is	sue : 10/2/2014. Version : 0.02	10/11
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Section 16. Other information

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

<u>History</u>	
Date of printing	: 10/15/2014.
Date of issue/Date of revision	: 10/15/2014.
Date of previous issue	: 10/2/2014.
Version	: 0.02
Key to abbreviations	 ATE = Acute Toxicity Estimate BCF = Bioconcentration Factor GHS = Globally Harmonized System of Classification and Labelling of Chemicals IATA = International Air Transport Association IBC = International Air Transport Association IBC = International Maritime Dangerous Goods LogPow = logarithm of the octanol/water partition coefficient MARPOL 73/78 = International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978. ("Marpol" = marine pollution) UN = United NationsACGIH – American Conference of Governmental Industrial Hygienists AIHA – American Industrial Hygiene Association CAS – Chemical Abstract Services CEPA – Canadian Environmental Protection Act CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act (EPA) CFR – United States Code of Federal Regulations CPR – Controlled Products Regulations CPR – Controlled Products Regulations DSL – Domestic Substances List GWP – Global Warming Potential IARC – International Agency for Research on Cancer ICAO – International Agency for Research on Cancer ICAO – International Civil Aviation Organisation Inh – Inhalation LC – Lethal concentration LD – Lethal dosage NDSL – Non-Domestic Substances List NIOSH – National Institute for Occupational Safety and Health TDG – Canadian Transportation of Dangerous Goods Act and Regulations TLV – Threshold Limit Value TSCA – Toxic Substances Control Act WEEL – Workplace Environmental Exposure Level WHMIS – Canadian Workplace Hazardous Material Information System
References	: Not available.

✓ Indicates information that has changed from previously issued version.

Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.

Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

Date of issue/Date of revision : 10/15/2014. Date of previous issue : 10/2/2014. Version : 0.02 11/3	Date of issue/Date of revision	: 10/15/2014.	Date of previous issue	: 10/2/2014.	Version	:0.02	11/11
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SAFETY DATA SHEET

Version 5.7 Revision Date 11/03/2015 Print Date 02/18/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Heptane	
	Product Number Brand Index-No.	: : :	246654 Sigma-Aldrich 601-008-00-2	
	CAS-No.	:	142-82-5	

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Skin irritation (Category 2), H315 Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336 Aspiration hazard (Category 1), H304 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H410	Very toxic to aquatic life with long lasting effects

Precautionary statement(s) P210

Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P312	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P331	Do NOT induce vomiting.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	С ₇ Н ₁₆
Molecular weight	:	100.20 g/mol
CAS-No.	:	142-82-5
EC-No.	:	205-563-8
Index-No.	:	601-008-00-2
Registration number	:	01-2119457603-38-XXXX

Hazardous components

Component	Classification	Concentration
Heptane		
	Flam. Liq. 2; Skin Irrit. 2; STOT SE 3; Asp. Tox. 1; Aquatic Acute 1; Aquatic Chronic 1; H225, H304, H315, H336, H410	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides Flash back possible over considerable distance.

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion. Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store under inert gas. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
	4 40 00 5	T) A (A	parameters	
Heptane	142-82-5	IWA	85.000000 ppm	USA. NIOSH Recommended
			350.000000	Exposure Limits
		0	119/113	
		C	440.000000	USA. NIUSH Recommended
				Exposure Limits
			1,800.000000	
	Demerke	15 minute es	mg/m3	
	Remarks			
		IWA	500.000000	USA. Occupational Exposure Limits
			ppm	(USHA) - Table Z-1 Limits for Air
			2,000.000000	Contaminants
		The column in	mg/m3	
		The value in	mg/m3 is approxir	
		IWA	400.00000	
			ppm	(120)
		Central Nerv	ous System impair	ment
		Upper Respi	ratory Tract irritatio	n
		STEL	500.000000	USA. ACGIH Threshold Limit Values
			ppm	(TLV)
		Central Nerv	ous System impair	rment
		Upper Respi	ratory Tract irritation	pn
		TWA	400.000000	USA. ACGIH Threshold Limit Values
			ppm	(TLV)
		Linner Respi	ous System impail	ment
		STEI	500 000000	LISA ACGIH Threshold Limit Values
		OTLL	000.000000	
			ppin	
		Central Nerv	ous System impair	ment
		Upper Respi	ratory Tract irritatio	ิท
		TWA	400 ppm	USA. ACGIH Threshold Limit Values
				(TLV)
		Central Nerv	ous System impair	rment
		Upper Respi	ratory Tract irritation	on
		STEL	500 ppm	USA. ACGIH Threshold Limit Values (TLV)
		Central Nerv	ous System impair	rment
		Upper Respi	ratory Tract irritation	on

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 65 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a) Appearance	Form: liquid
b) Odour	No data available
c)) Odour Threshold	No data available
d) pH	No data available
e) Melting point/freezing point	Melting point/range: -91 °C (-132 °F)
f)	Initial boiling point and boiling range	98 °C (208 °F)
g) Flash point	-3.99 °C (24.82 °F) - closed cup
h) Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 7 %(V) Lower explosion limit: 1.1 %(V)
k)) Vapour pressure	110.7 hPa (83.0 mmHg) at 37.7 °C (99.9 °F) 53.3 hPa (40.0 mmHg) at 20.0 °C (68.0 °F)
l) Sigma-Ald	Vapour density	No data available
oigina-Alu		

m)	Relative density	0.684 g/mL at 25 °C (77 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n- octanol/water	log Pow: > 3.000
p)	Auto-ignition temperature	223.0 °C (433.4 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5 Incompatible materials** Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

LC50 Inhalation - Rat - 4 h - 103,000 mg/m3

Inhalation: Irritating to respiratory system.

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation

Eyes - Rabbit Result: No eye irritation (OECD Test Guideline 405)

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

May be fatal if swallowed and enters airways.

Additional Information

RTECS: MI7700000

Prolonged or repeated exposure to skin causes defatting and dermatitis., Central nervous system depression, narcosis, Damage to the lungs.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Carassius auratus (goldfish) - 4 mg/l - 24.0 h

LC50 - Tilapia mossambica - 375 mg/l - 96.0 h

Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 1.50 mg/l - 48 h other aquatic invertebrates

12.2 Persistence and degradability

Ratio BOD/ThBOD 3.5 %

12.3 Bioaccumulative potential Indication of bioaccumulation.

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

Do not empty into drains. Avoid release to the environment.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1206 Class: 3 Proper shipping name: Heptanes Reportable Quantity (RQ): Marine pollutant:yes Poison Inhalation Hazard: No	Packing group: II		
IMDG UN number: 1206 Class: 3 Proper shipping name: HEPTANES Marine pollutant:yes	Packing group: II	EMS-No: F-E, S-D	
IATA UN number: 1206 Class: 3 Proper shipping name: Heptanes	Packing group: II		

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

CAS-No.	Revision Date
142-82-5	1993-04-24
CAS-No.	Revision Date
142-82-5	1993-04-24
CAS-No.	Revision Date
142-82-5	1993-04-24
	CAS-No. 142-82-5 CAS-No. 142-82-5 CAS-No. 142-82-5

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity

Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H336	May cause drowsiness or dizziness.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.
Skin Irrit.	Skin irritation

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	
NFPA Rating	

IN LA Running	
Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.7

Revision Date: 11/03/2015

Print Date: 02/18/2016

MATERIAL SAFETY DATA SHEET

ERA A Waters Company

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

MANUFACTURER: ADDRESS:	ERA (Environmental Resource Associates) 6000 W. 54 th Avenue Arvada, CO, 80002 U.S.A.	BUSINESS PHONE: FAX: 303-421-0159 EMAIL: CHEMICAL EMERGENCY PHONE:	303-431-8454 info@eraqc.com 352-535-5053 (INFOTRAC)
Product Name(s): Catalog / Part Number(s): MSDS Creation Date: Revision Date:	Hexavalent Chromium 1000 mg/L 019, 973, 186004178 November 22, 2005 September 29, 2009	MSDS Reference Number: 019	

SECTION 2: HAZARDS IDENTIFICATION

Toxic. Harmful by inhalation. May cause cancer. Risk of cancer depends on duration and level of exposure. The matrix of each standard is a K2Cr2O7/water mixture listed below which is classified as dangerous by Directive 199/45/EC. Use only as directed and in accordance with good laboratory practices.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

				EXPOSUF	RE LIMITS	EU LABEL
CHEMICAL INGREDIENT NAME	CAS NUMBER	EC NUMBER	% BY WT.	OSHA	ACGIH	HAZARD LABEL
Potassium dichromate	7778-50-9	231-906-6	≤0.1	0.1 mg/m3 PEL	0.05 mg/m3	

Notes: This standard is 125 mL of a mixture containing potassium dichromate salt with the balance being ≥99.9% water. Hexavalent chromium is a known human carcinogen. Exposure Limits are 8-Hour TWA (Time Weighted Average) unless designated C (Ceiling) or STEL (Short Term Exposure Limit). Other components considered Non-Hazardous under OSHA 1910.1200 (HazCom) as they are not present in concentrations exceeding 1% (or 0.1% if considered a known or potential carcinogen). Material Use: Analytical reagent or certified reference material used in laboratories. Uses also include research and development.

SECTION 4: FIRST-AID MEASURES

Inhalation: Remove to fresh air. Skin Contact: Flush with water. Eye Contact: Immediately flush with water for a minimum of 15 minutes. Ingestion: Get medical attention After following first aid measures, seek medical attention.

SECTION 5: FIRE-FIGHTING MEASURES

Flammable Properties: Not flammable. Extinguishing Media: Dry chemical, carbon dioxide or appropriate foam. Unique Aspects Contributing To a Fire: None. Special Fire Fighting Procedures: None. Note: As in any fire, wear self-contained breathing apparatus, and full protective gear.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Absorb liquid with spill pillow or other absorbent. Ventilate and wash spill site after material pick up is complete. Place wastes into closed containers for proper disposal.

SECTION 7: HANDLING AND STORAGE

Handle in accordance with good laboratory practices. Store in a dry well-ventilated place. This product is intended for use only by people trained in the safety and handling of chemicals and laboratory preparations.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Handle in accordance with good laboratory practices. Wash thoroughly after handling. Respiratory Protection: Not normally needed. If exposure limits are exceeded, use approved respirator. Eye Protection: Safety glasses with side shields or safety goggles Skin Protection: Neoprene or other chemical resistant gloves. Engineering Controls: Not normally needed. If exposure limits are exceeded, work in a fume hood.

MATERIAL SAFETY DATA SHEET

ERA A Waters Company

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

DATA FOR MATRIX:

Appearance:	Clear to yellow	Specific Gravity:	NA	Melting Point:	NA	
Physical State:	Liquid	Flash Point:	NA	Vapor Pressure:	NA	
Odor:	NA	Explosion Limits:	NA	Vapor Density (air=1):	NA	
pH:	NA	Boiling Point:	NA	Solubility in Water:	Soluble	

Stability: Stable X_

Unstable

SECTION 10: STABILITY AND REACTIVITY

Hazardous Polymerization Will Not Occur X_ May Occur_ Hazardous Decomposition/Combustion Products: NA Conditions and Materials to Avoid: Oxidizing agents.

SECTION 11: TOXICOLOGICAL INFORMATION

Primary Route(s) of Exposure Under Normal Use: Skin contact: may cause skin irritation or be harmful if absorbed through skin. Eye contact: may cause eye irritation. Inhalation: hamful if inhaled, may be irritation to mucous membranes and upper respiratory tract. Ingestion: harmful if swallowed.

Target Organ(s): Lungs, kidneys, blood.

Acute Effects: Harmful by inhalation. May cause sensitization by inhalation and skin contact. Ingestion can cause vomiting. Potassium dichromate: Oral, child: LDLO=26 mg/kg; Oral, man: LDLO=143 mg/kg; Oral, rat:LD50=25 mg/kg; Skin, rabbit:LD50=14 mg/kg.

Chronic Effects: Carcinogen; Teratogen; May cause heritable gentic damage. Reproductive hazard; May impair fertility. May cause harm to the unborn child.

Other Information: Chemical Ingredient(s) potassium dichromate is classified as carcinogen(s) by OSHA, IARC (Group 1), NTP, ACGIH (A1), or California. California Prop-65: This product is or contains chemicals known to the state of California to cause cancer.

SECTION 12: ECOLOGICAL INFORMATION

Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Avoid release into the environment.

SECTION 13: DISPOSAL CONSIDERATIONS

To determine proper disposal, consult applicable federal, state and local environmental control regulations.

SECTION 14: TRANSPORT INFORMATION

 Shipment Name/Type:
 Non-hazardous for transport.

 UN Number:
 NA
 Shipping/Hazardous Class: NA
 Packing Group: NA

 Shipping regulations are based on combinations of criteria such as guantity, class and packaging according to DOT, IATA and (49) CFR.
 Complexity of the second s

SECTION 15: REGULATORY INFORMATION

EU Symbol of Danger: Toxic (T) concentration ≤0.1 C <0.2% EU Risk Phrases: May cause cancer [R45]; May cause heritable genetic damage [R46]; Harmful by inhalation [R20].

U.S. TSCA: Listed Canada: This product has been classified according to the hazard criteria of the CPR and this MSDS contains all the information required by the CPR.

SECTION 16: OTHER INFORMATION

United States EPA Regulato	ry Information:	NFPA Rating:	Health: 3	Flammability: 0	Reactivity: 0
SARA 313: CERCLA RQ:	Yes (0.1% deminimis) 10 lbs	HMIS Rating:	Health: 3	Flammability: 0	Physical Hazard: 0

NOTE: NA = Data not available, not established, determined or not pertinent.

DISCLAIMER: The information contained herein has been compiled from data presented in various technical sources believed to be accurate. This information is intended to be used only as a guide and does not purport to be complete. ERA makes no warranties and assumes no liability in connection with the use of this information. It is the user's responsibility to determine the suitability of this information and to assure the adoption of necessary precautions.

Safety data for indeno[1,2,3-cd]pyrene

Glossary of terms on this data sheet.

The information on this web page is provided to help you to work safely, but it is intended to be an overview of hazards, not a replacement for a full Material Safety Data Sheet (MSDS). MSDS forms can be downloaded from the web sites of many chemical suppliers.

General

```
Synonyms: 1,10-(1,2-phenylene)pyrene, 1,10-(o-phenylene)pyrene, o-
phenylenepyrene, 2,3-phenylenepyrene, 2,3,o-phenylenepyrene, IP
Use:
Molecular formula: C<sub>22</sub>H<sub>12</sub>
CAS No: 193-39-5
EINECS No: 205-893-2
```

Physical data

```
Appearance: solid
Melting point: 161 - 163 C
Boiling point: 536 C
Vapour density:
Vapour pressure:
Density (g cm<sup>-3</sup>):
Flash point:
Explosion limits:
Autoignition temperature:
Water solubility:
```

Stability

Stable. Incompatible with strong oxidizing agents.

Toxicology

Limited evidence that this material may be carcinogenic.

Toxicity data

(The meaning of any toxicological abbreviations which appear in this section is given <u>here.</u>)

Risk phrases

(The meaning of any risk phrases which appear in this section is given <u>here.</u>) R40.

Transport information

(The meaning of any UN hazard codes which appear in this section is given <u>here.</u>)

Non-hazardous for air, sea and road freight.

Personal protection

Treat as potentially hazardous - many multi-ring aromatic compounds are suspected carcinogens.

Safety phrases

(The meaning of any safety phrases which appear in this section is given <u>here.</u>) S36 S37 S45.

[Return to Physical & Theoretical Chemistry Lab. Safety home page.]

This information was last updated on May 10, 2005. We have tried to make it as accurate and useful as possible, but can take no responsibility for its use, misuse, or accuracy. We have not verified this information, and cannot guarantee that it is up-to-date.

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Health	1
Fire	2
Reactivity	1
Personal Protection	E

Material Safety Data Sheet Iron Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Iron Metal Catalog Codes: SLI2047, SLI1996 CAS#: 7439-89-6 RTECS: NO4565500 TSCA: TSCA 8(b) inventory: Iron Metal CI#: Not applicable. Synonym: Chemical Name: Iron

Chemical Formula: Fe

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: **1-800-901-7247** International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Iron Metal, powder	7439-89-6	100

Toxicological Data on Ingredients: Not applicable.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to liver, cardiovascular system, upper respiratory tract, pancreas. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention if symptoms appear.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Flammable in presence of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Explosive in presence of open flames and sparks, of heat.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Chlorine Trifluoride reacts with iron with incandescence. Powdered iron reacts with fluorine below redness with incandescence. Reduced iron decomposes with nitrogen dioxide @ ordinary temperature with incandescence. Reacting mass formed by mixture of phosphorus and iron can become incandescent when heated. This material is flammable in powder form only.

Special Remarks on Explosion Hazards: Material in powdered form can explode when exposed to heat or flame

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Do not ingest. Do not breathe dust. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents, acids.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Solid metallic powder.)

Odor: Odorless.

Taste: Tasteless.

Molecular Weight: 55.85 g/mole

Color: Black to Grey.

pH (1% soln/water): Not applicable.

Boiling Point: 3000°C (5432°F)

Melting Point: 1535°C (2795°F)

Critical Temperature: Not available.

Specific Gravity: Density: 7.86 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, ignition sources, incompatible materials, water/moisture, air, dust generation.

Incompatibility with various substances:

Reactive with oxidizing agents, acids. Slightly reactive to reactive with moisture.

Corrosivity: Not considered to be corrosive for metals and glass.

Special Remarks on Reactivity:

Hot iron(wire) burns in Chlorine gas. Violent decompositon of hydrogen peroxide (53% by weight or greater) may be caused by contact with iron. Readily oxidizes in moist air forming rust. Reactive with halogens. Incompatible with acetaldehyde, ammonium peroxodisulfate, chloroformamidinum, chloric acid, ammonium nitrate, dinitorgen tetroxide, nitryl fluoride, polystyrene, sodium acetylide, potassium dichromate, peroxyformic acid, sulfuric acid, sodium carbide. Readily attacked by dilute mineral acids and or attacked or dissolved by organic acids. Not appreciably attacked by cold sulfuric acid, or nitric acid, but is attacked by hot acids.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals: Acute oral toxicity (LD50): 30000 mg/kg [Rat].

Chronic Effects on Humans: May cause damage to the following organs: liver, cardiovascular system, upper respiratory tract, pancreas.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: Iron metal filings or dust: May cause skin irritation by mechanical action. Iron metal wire: Not likely to cause skin irritation Eyes: Iron metal filings or dust: Can irritate eyes by mechanical action. Iron metal wire: No hazard. Will not cause eye irritation. Inhalation: Iron dust: Can irritate the respiratory tract by mechanical action. Iron metal wire or filings: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Iron metal wire: Not an ingestion hazard: Iron metal filings or dust: The amount of ingested iron which constitutes a toxic dose is not well defined. Proposed toxic doses of elemental iron are 20 mg/kg for gastrointestinal irritation to greater than 60 mg/kg for systemic toxicity. Gastrointestinal effects are the first signs to appear, with hemorrhagic vomiting and diarrhea, hematochezia, abdominal pain, lethargy, metabolic acidosis, coagulaopathy, shock, coma and convulsions developing from 0 to 6 hours after ingestion. Leukocytosis may also occur. An asymptomatic phase may ensue at 6 to 12 hours postingestion, followed by hypoglycemia or hyperglycemia, hepatic and renal failure, severe acidosis, cyanosis, fever, CNS depression (lethargy, restlessness and/or confusion seizures), hypotension, and cardiovascular collapse/cardiac failure in 12 to 48 hours. Hepatic cirrhosis, gastrointestinal scarring and/or strictures may arise in 2 to 6 weeks. It may also cause an anaphylactoid reaction. Non-cardiogenic pulmonary edema also develop in severe cases of iron intoxication. Chronic Potential Health Effects: Inhalation: Chronic inhalation of iron dust can lead to accumulation in the lungs and a characteristic stippled appearance on X-rays. This condition, called SIDEROSIS, is considered benign in that it does not interfere with lung function and does not predispose to other disease. Chronic inhalation of iron dust may also cause fibrosis in the lungs. Ingestion: Clinical signs of iron overload appear when the total body iron is 5 to 10 times higher than normal. Neurobehavioral defects including depression, decreased activity, habituation, reflex startle, and conditioned avoidance response performance may occur. However, similiar effects were also seen in iron defficiency. It is therefore likely that these behavioral effects are secondary to general toxicity. High serum iron levels may be associated with an increased risk of fatal acute myocardial infarction (MI). Skin: Prolonged or repeated contact may cause hypersensivity.

Section 12: Ecological Information

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The product itself and its products of degradation are not toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Metal powder, flammable, n.o.s. (Iron metal powder) UNNA: 3089 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

California Director's List of Hazardous Substances: Iron Metal TSCA 8(b) inventory: Iron Metal

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS B-4: Flammable solid.

DSCL (EEC):

R11- Highly flammable. S16- Keep away from sources of ignition - No smoking. S22- Do not breathe dust.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 2

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 2

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

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Last Updated: 11/06/2008 12:00 PM

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sigma-aldrich.com

SAFETY DATA SHEET

Version 5.8 Revision Date 03/06/2015 Print Date 02/18/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Isopropyl alcohol	
	Product Number Brand Index-No.	: : :	W292907 Aldrich 603-117-00-0	
	CAS-No.	:	67-63-0	
1.2	1.2 Relevant identified uses of the substance or mixture and uses advised			
	Identified uses	:	Laboratory chemicals, Manufacture of substances	
1.3	Details of the supplier of the	ne s	safety data sheet	
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052	
1.4	Emergency telephone num	ıbe	r	

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Eye irritation (Category 2A), H319 Specific target organ toxicity - single exposure (Category 3), Central nervous system, H336

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.

P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1	Substances Synonyms	:	2-Propanol sec-Propyl alcohol Isopropyl alcohol Isopropanol
	Formula	:	C ₃ H ₈ O
	Molecular weight	:	60.10 g/mol
	CAS-No.	:	67-63-0
	EC-No.	:	200-661-7
	Index-No.	:	603-117-00-0

Hazardous components

Component	Classification	Concentration
2-Propanol		
	Flam. Liq. 2; Eye Irrit. 2A; STOT SE 3; H225, H319, H336	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Move out of dangerous area. Consult a physician. Show this safety data sheet to the doctor in attendance.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Handle and store under inert gas. hygroscopic

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
2-Propanol	67-63-0	TWA	200.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nervous System impairment		

Upper Respi Eye irritation Substances (see BEI® se Not classifial TWA	ratory Tract irritation for which there is a pection) ple as a human ca 200 ppm	on a Biological Exposure Index or Indices rcinogen USA. ACGIH Threshold Limit Values
Central Nerv	ous System impai	rment
Upper Respi	ratory Tract irritation	วท
Eye irritation	for which there is a	Biological Exposure Index or Indices
(see BEI® se	ection)	
Not classifial	ole as a human ca	
STEL	400 ppm	USA. ACGIH Threshold Limit Values
Central Nerv	ous System impai	rment
Upper Respi	ratory Tract irritatio	on
Substances	for which there is a	a Biological Exposure Index or Indices
(see BEI® se	ection)	
NOT CIASSIIIAI		IISA ACGIH Threshold Limit Values
SILL	ppm	(TLV)
Central Nerv Upper Respi Eye irritation Substances (see BEI® se	ous System impair ratory Tract irritation for which there is a action)	rment on a Biological Exposure Index or Indices
Not classifial	ole as a human ca	rcinogen
TWA	400.000000 ppm 980.000000	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
The value in	mg/m3 mg/m3 is approxim	nate
TWA	400.000000	USA, NIOSH Recommended
	ppm 980.000000 mg/m3	Exposure Limits
ST	500.000000 ppm 1,225.000000 mg/m3	USA. NIOSH Recommended Exposure Limits

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis
2-Propanol	67-63-0	Acetone	40.0000 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift at e	end of workv	veek	

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 60 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

impervious clothing, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	alcohol-like
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -89.5 °C (-129.1 °F) - lit
f)	Initial boiling point and boiling range	82 °C (180 °F) - lit.
g)	Flash point	12.0 °C (53.6 °F) - closed cup
h)	Evaporation rate	3.0
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or	Upper explosion limit: 12.7 %(V) Lower explosion limit: 2 %(V)

explosive limits

k)	Vapour pressure	43.2 hPa (32.4 mmHg) at 20.0 °C (68.0 °F) 58.7 hPa (44.0 mmHg) at 25.0 °C (77.0 °F)
I)	Vapour density	No data available
m)	Relative density	0.785 g/cm3 at 25 °C (77 °F)
n)	Water solubility	completely soluble
o)	Partition coefficient: n- octanol/water	log Pow: 0.05
p)	Auto-ignition temperature	425.0 °C (797.0 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	er safety information	
	Surface tension	20.8 mN/m at 25.0 °C (77.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

10.2 Chemical stability

Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year. Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks. Extremes of temperature and direct sunlight.

10.5 Incompatible materials Oxidizing agents, Acid anhydrides, Aluminium, Halogenated compounds, Acids

10.6 Hazardous decomposition products

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 5,045 mg/kg Remarks: Behavioral:Altered sleep time (including change in righting reflex). Behavioral:Somnolence (general depressed activity).

LC50 Inhalation - Rat - 8 h - 16000 ppm

LD50 Dermal - Rabbit - 12,800 mg/kg

No data available

Skin corrosion/irritation Skin - Rabbit

Result: Mild skin irritation

Serious eye damage/eye irritation

Eyes - Rabbit Result: Eye irritation - 24 h

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (2-Propanol)

- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure

Inhalation, Oral - May cause drowsiness or dizziness.

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Additional Information

RTECS: NT8050000

Central nervous system depression, prolonged or repeated exposure can cause:, Nausea, Headache, Vomiting, narcosis, Drowsiness, Overexposure may cause mild, reversible liver effects., Aspiration may lead to:, Lung oedema, Pneumonia

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Kidney - Irregularities - Based on Human Evidence Kidney - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 9,640.00 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 5,102.00 mg/l - 24 h
	Immobilization EC50 - Daphnia magna (Water flea) - 6,851 mg/l - 24 h
Toxicity to algae	EC50 - Desmodesmus subspicatus (green algae) - > 2,000.00 mg/l - 72 h
	EC50 - Algae - > 1,000.00 mg/l - 24 h

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential

No bioaccumulation is to be expected (log Pow <= 4).

- 12.4 Mobility in soil No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 1219 Class: 3 Packing group: II Proper shipping name: Isopropanol Reportable Quantity (RQ): Poison Inhalation Hazard: No IMDG UN number: 1219 Class: 3 Packing group: II EMS-No: F-E, S-D Proper shipping name: ISOPROPANOL ΙΑΤΑ UN number: 1219 Class: 3 Packing group: II Proper shipping name: Isopropanol **15. REGULATORY INFORMATION** SARA 302 Components No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302. **SARA 313 Components** The following components are subject to reporting levels established by SARA Title III, Section 313: CAS-No. **Revision Date** 67-63-0 1987-01-01 2-Propanol SARA 311/312 Hazards Fire Hazard, Acute Health Hazard, Chronic Health Hazard Massachusetts Right To Know Components CAS-No. **Revision Date** 2-Propanol 67-63-0 1987-01-01 Pennsylvania Right To Know Components CAS-No. **Revision Date** 1987-01-01 2-Propanol 67-63-0 **New Jersey Right To Know Components** CAS-No. **Revision Date** 1987-01-01 2-Propanol 67-63-0 California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
STOT SE	Specific target organ toxicity - single exposure
HMIS Rating	
Health hazard:	2
Chronic Health Haza	ard: *
Flammability:	3
Physical Hazard	0
NFPA Rating	
Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.8

Revision Date: 03/06/2015

Print Date: 02/18/2016





Health	1
Fire	0
Reactivity	0
Personal Protection	Е

Material Safety Data Sheet Lead MSDS

Section 1: Chemical Product and Company Identification

Product Name: Lead

Catalog Codes: SLL1291, SLL1669, SLL1081, SLL1459, SLL1834

CAS#: 7439-92-1

RTECS: OF7525000

TSCA: TSCA 8(b) inventory: Lead

Cl#: Not available.

Synonym: Lead Metal, granular; Lead Metal, foil; Lead Metal, sheet; Lead Metal, shot

Chemical Name: Lead

Chemical Formula: Pb

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: **1-800-901-7247** International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Lead	7439-92-1	100

Toxicological Data on Ingredients: Lead LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

Slightly hazardous in case of skin contact (permeator). CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to blood, kidneys, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

Fire Hazards in Presence of Various Substances: Non-flammable in presence of open flames and sparks, of shocks, of heat.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards: When heated to decomposition it emits highly toxic fumes of lead.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Use a shovel to put the material into a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Wear suitable

protective clothing. If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 0.05 (mg/m3) from ACGIH (TLV) [United States] TWA: 0.05 (mg/m3) from OSHA (PEL) [United States] TWA: 0.03 (mg/m3) from NIOSH [United States] TWA: 0.05 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 207.21 g/mole

Color: Bluish-white. Silvery. Gray

pH (1% soln/water): Not applicable.

Boiling Point: 1740°C (3164°F)

Melting Point: 327.43°C (621.4°F)

Critical Temperature: Not available.

Specific Gravity: 11.3 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, excess heat

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Can react vigorously with oxidizing materials. Incompatible with sodium carbide, chlorine trifluoride, trioxane + hydrogen peroxide, ammonium nitrate, sodium azide, disodium acetylide, sodium acetylide, hot concentrated nitric acid, hot concentrated hydrochloric acid, hot concentrated sulfuric acid, zirconium.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: Classified A3 (Proven for animal.) by ACGIH, 2B (Possible for human.) by IARC. May cause damage to the following organs: blood, kidneys, central nervous system (CNS).

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential: Skin: Lead metal granules or dust: May cause skin irritation by mechanical action. Lead metal foil, shot or sheets: Not likely to cause skin irritation Eyes: Lead metal granules or dust: Can irritate eyes by mechanical action. Lead metal foil, shot or sheets: No hazard. Will not cause eye irritation. Inhalation: In an industrial setting, exposure to lead mainly occurs from inhalation of dust or fumes. Lead dust or fumes: Can irritate the upper respiratory tract (nose, throat) as well as the bronchi and lungsby mechanical action. Lead dust can be absorbed through the respiratory system. However, inhaled lead does not accumulate in the lungs. All of an inhaled dose is eventually absorbed or transferred to the gastrointestinal tract. Inhalation effects of exposure to fumes or dust of inorganic lead may not develop quickly. Symptoms may include metallic taste, chest pain, decreased physical fitness, fatigue, sleep disturbance, headache, irritability, reduces memory, mood and personality changes, aching bones and muscles, constipation, abdominal pains, decreasing appetite. Inhalation of large amounts may lead to ataxia, deliriuim, convulsions/seizures, coma, and death. Lead metal foil, shot, or sheets: Not an inhalation hazard unless metal is heated. If metal is heated, fumes will be released. Inhalation of these fumes may cause "fume metal fever", which is characterized by flu-like symptoms. Symptoms may include metallic taste, fever, nausea, vomiting, chills, cough, weakness, chest pain, generalized muscle pain/aches, and increased white blood cell count. Ingestion: Lead metal granules or dust: The symptoms of lead poisoning include abdominal pain or cramps (lead cholic), spasms, nausea, vomiting, headache, muscle weakness, hallucinations, distorted perceptions, "lead line" on the gums, metallic taste, loss of appetite, insomnia, dizziness and other symptoms similar to that of inhalation. Acute poisoning may result in high lead levels in the blood and urine, shock, coma and death in extreme cases. Lead metal foil, shot or sheets: Not an ingestion hazard for usual industrial handling.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer, birth defects or other reproductive harm, which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause reproductive harm (female) which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California prop. 65: This product contains the following ingredients for which the State of California prop. 65: This product contains the following ingredients for which the State of California prop. 65 (no significant risk level): Lead: 0.0005 mg/day (value) California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause birth defects which would require a warning under the statute: Lead California prop. 65: This product contains the following ingredients for which the State of California has found to cause cancer which would require a warning under the statute: Lead Connecticut hazardous material survey.: Lead Illinois toxic substances disclosure to employee act: Lead Illinois chemical safety act: Lead New York release reporting list: Lead Rhode Island RTK hazardous substances: Lead Pennsylvania RTK: Lead

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC):

R20/22- Harmful by inhalation and if swallowed. R33- Danger of cumulative effects. R61- May cause harm to the unborn child. R62- Possible risk of impaired fertility. S36/37- Wear suitable protective clothing and gloves. S44- If you feel unwell, seek medical advice (show the label when possible). S53- Avoid exposure - obtain special instructions before use.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 0

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 1

Flammability: 0

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 08:21 PM

Last Updated: 11/06/2008 12:00 PM

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SAFETY DATA SHEET

Version 4.6 Revision Date 03/02/2015 Print Date 02/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Manganese	
	Product Number Brand	:	463728 Aldrich	
	CAS-No.	:	7439-96-5	
1.2	Relevant identified uses of the substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Manufacture of substances	
1.3	Details of the supplier of the safety data sheet			
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
	Telephone	:	+1 800-325-5832	

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

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2. HAZARDS IDENTIFICATION

Fax

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260 Acute aquatic toxicity (Category 3), H402 Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

+1 800-325-5052

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H260	In contact with water releases flammable gases which may ignite spontaneously.
H412	Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232	Handle under inert gas. Protect from moisture.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P335 + P334	Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.

P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404	Store in a dry place. Store in a closed container.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: Mn	
Molecular weight	: 54.94 g/mo	
CAS-No.	: 7439-96-5	
EC-No.	: 231-105-1	

Hazardous components

Component	Classification	Concentration	
Manganese			
	Water-react. 1; Aquatic Acute 3; Aquatic Chronic 3; H260, H412	<= 100 %	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Dry powder Carbon dioxide (CO2)

Unsuitable extinguishing media Water

5.2 Special hazards arising from the substance or mixture Manganese/manganese oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wetbrushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.

Moisture sensitive. Keep in a dry place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis	
			parameters		
Manganese	7439-96-5	TWA	0.200000	USA. ACGIH Threshold Limit Values	
			mg/m3	(TLV)	
	Remarks	Central Nervous System impairment Adopted values or notations enclosed are those for which changes			
		are proposed in the NIC			
		See Notice of Intended Changes (NIC)			
		С	5 mg/m3	USA. Occupational Exposure Limits	
				(OSHA) - Table Z-1 Limits for Air	
				Contaminants	
		Ceiling limit is to be determined from breathing-zone air samples.			
		С	5.000000	USA. Occupational Exposure Limits	
			mg/m3	(OSHA) - Table Z-1 Limits for Air	
			-	Contaminants	
		Ceiling limit is to be determined from breathing-zone air samples.			
TWA	1.000000	USA. NIOSH Recommended			
--------------------------------------	---------------------	------------------------------------	--		
	mg/m3	Exposure Limits			
ST	3.000000	USA. NIOSH Recommended			
	mg/m3	Exposure Limits			
TWA	1.000000	USA. NIOSH Recommended			
	mg/m3	Exposure Limits			
ST	3.000000	USA. NIOSH Recommended			
	mg/m3	Exposure Limits			
С	5.000000	USA. Occupational Exposure Limits			
	mg/m3	(OSHA) - Table Z-1 Limits for Air			
		Contaminants			
Ceiling limit	is to be determined	from breathing-zone air samples.			
TWA	1.000000	USA. NIOSH Recommended			
	mg/m3	Exposure Limits			
ST	3.000000	USA. NIOSH Recommended			
	mg/m3	Exposure Limits			
TWA	0.200000	USA. ACGIH Threshold Limit Values			
	mg/m3	(TLV)			
Central Nerv	ous System impair	ment			
Adopted value	ues or notations en	closed are those for which changes			
are proposed in the NIC					
See Notice of Intended Changes (NIC)					
 varies					
TWA	0.100000	USA. ACGIH Threshold Limit Values			
	mg/m3	(TLV)			
Central Nerv	ous System impaii	ment			
2014 Adopti	on				
 varies		L			
TWA	0.020000	USA. ACGIH Threshold Limit Values			
	mg/m3	(TLV)			
Central Nerv	ous System impair	ment			
2014 Adopti	on				
 varies					
TWA	0.1 mg/m3	USA. ACGIH Threshold Limit Values			
 _		(TLV)			
Central Nervous System impairment					
varies					
TWA	0.02 mg/m3	USA. ACGIH Threshold Limit Values			
		(TLV)			
Central Nerv	ous System impair	ment			
varies					

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 1,244 °C (2,271 °F) - lit
f)	Initial boiling point and boiling range	1,962 °C (3,564 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	7.3 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety information	

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** Reacts violently with water.
- **10.4** Conditions to avoid Exposure to moisture
- **10.5** Incompatible materials acids, Halogens, Bases, Phosphorus, Sulphur oxides, Peroxides

10.6 Hazardous decomposition products

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 9,000 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - Rabbit Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

Carcinogenicity - Rat - Intramuscular

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic:Tumors at site or application.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

May cause reproductive disorders.

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: 009275000

Men exposed to manganese dusts showed a decrease in fertility. Chronic manganese poisoning primarily involves the central nervous system. Early symptoms include languor, sleepiness and weakness in the legs. A stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter and a spastic gait with tendency to fall in walking are findings in more advanced cases. High incidence of pneumonia has been found in workers exposed to the dust or fume of some manganese compounds.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 40 mg/l - 48 h other aquatic invertebrates

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Harmful to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3208 Class: 4.3 Packing group: I Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)

Poison Inhalation Hazard: No

IMDG

UN number: 3208 Class: 4.3 Packing group: I EMS-No: F-G, S-N Proper shipping name: METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S. (Manganese)

ΙΑΤΑ

UN number: 3208 Class: 4.3 Packing group: I Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese) IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
SARA 311/312 Hazards Reactivity Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H260	In contact with water releases flammable gases which may ignite spontaneously.
H402	Harmful to aquatic life.
H412	Harmful to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	2

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	2
Special hazard.I:	W

Further information

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Preparation Information Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.6

Revision Date: 03/02/2015

Print Date: 02/07/2016

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SAFETY DATA SHEET

Version 4.6 Revision Date 03/02/2015 Print Date 02/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Manganese		
	Product Number Brand	:	463728 Aldrich		
	CAS-No.	:	7439-96-5		
1.2	Relevant identified uses	Relevant identified uses of the substance or mixture and uses advised against			
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		
	Telephone	:	+1 800-325-5832		

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

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2. HAZARDS IDENTIFICATION

Fax

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260 Acute aquatic toxicity (Category 3), H402 Chronic aquatic toxicity (Category 3), H412

For the full text of the H-Statements mentioned in this Section, see Section 16.

+1 800-325-5052

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H260	In contact with water releases flammable gases which may ignite spontaneously.
H412	Harmful to aquatic life with long lasting effects.
Precautionary statement(s)	
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire.
P231 + P232	Handle under inert gas. Protect from moisture.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P335 + P334	Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.

P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P402 + P404	Store in a dry place. Store in a closed container.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	: Mn	
Molecular weight	: 54.94 g/mo	
CAS-No.	: 7439-96-5	
EC-No.	: 231-105-1	

Hazardous components

Component	Classification	Concentration
Manganese		
	Water-react. 1; Aquatic Acute 3; Aquatic Chronic 3; H260, H412	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Dry powder Carbon dioxide (CO2)

Unsuitable extinguishing media Water

5.2 Special hazards arising from the substance or mixture Manganese/manganese oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wetbrushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.

Moisture sensitive. Keep in a dry place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
Manganese	7439-96-5	TWA	0.200000	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
	Remarks	Central Nerv	ous System impair	ment
		Adopted valu	les or notations en	closed are those for which changes
		are proposed	l in the NIC	-
		See Notice o	f Intended Change	s (NIC)
		С	5 mg/m3	USA. Occupational Exposure Limits
				(OSHA) - Table Z-1 Limits for Air
				Contaminants
		Ceiling limit is to be determined from breathing-zone air samples.		
		С	5.000000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
			-	Contaminants
		Ceiling limit i	s to be determined	from breathing-zone air samples.

TWA	1.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
ST	3.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
TWA	1.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
ST	3.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
С	5.000000	USA. Occupational Exposure Limits
	mg/m3	(OSHA) - Table Z-1 Limits for Air
		Contaminants
Ceiling limit	is to be determined	from breathing-zone air samples.
TWA	1.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
ST	3.000000	USA. NIOSH Recommended
	mg/m3	Exposure Limits
TWA	0.200000	USA. ACGIH Threshold Limit Values
	mg/m3	(TLV)
Central Nerv	ous System impair	ment
Adopted value	ues or notations en	closed are those for which changes
are propose	d in the NIC	
See Notice of	of Intended Change	es (NIC)
 varies		
TWA	0.100000	USA. ACGIH Threshold Limit Values
	mg/m3	(TLV)
Central Nerv	ous System impaii	ment
2014 Adopti	on	
 varies	1	L
TWA	0.020000	USA. ACGIH Threshold Limit Values
	mg/m3	(TLV)
Central Nerv	ous System impair	ment
2014 Adopti	on	
 varies		
TWA	0.1 mg/m3	USA. ACGIH Threshold Limit Values
		(TLV)
Central Nerv	ous System impair	ment
varies		
TWA	0.02 mg/m3	USA. ACGIH Threshold Limit Values
		(TLV)
Central Nerv	ous System impair	ment
varies		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

impervious clothing, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 1,244 °C (2,271 °F) - lit
f)	Initial boiling point and boiling range	1,962 °C (3,564 °F) - lit.
g)	Flash point	Not applicable
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	7.3 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety information	

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** Reacts violently with water.
- **10.4** Conditions to avoid Exposure to moisture
- **10.5** Incompatible materials acids, Halogens, Bases, Phosphorus, Sulphur oxides, Peroxides

10.6 Hazardous decomposition products

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 9,000 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Mild skin irritation - 24 h

Serious eye damage/eye irritation

Eyes - Rabbit Result: Mild eye irritation - 24 h

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

Carcinogenicity - Rat - Intramuscular

Tumorigenic:Equivocal tumorigenic agent by RTECS criteria. Tumorigenic:Tumors at site or application.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

May cause reproductive disorders.

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: 009275000

Men exposed to manganese dusts showed a decrease in fertility. Chronic manganese poisoning primarily involves the central nervous system. Early symptoms include languor, sleepiness and weakness in the legs. A stolid mask-like appearance of the face, emotional disturbances such as uncontrollable laughter and a spastic gait with tendency to fall in walking are findings in more advanced cases. High incidence of pneumonia has been found in workers exposed to the dust or fume of some manganese compounds.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to daphnia and EC50 - Daphnia magna (Water flea) - 40 mg/l - 48 h other aquatic invertebrates

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Harmful to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3208 Class: 4.3 Packing group: I Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese)

Poison Inhalation Hazard: No

IMDG

UN number: 3208 Class: 4.3 Packing group: I EMS-No: F-G, S-N Proper shipping name: METALLIC SUBSTANCE, WATER-REACTIVE, N.O.S. (Manganese)

ΙΑΤΑ

UN number: 3208 Class: 4.3 Packing group: I Proper shipping name: Metallic substance, water-reactive, n.o.s. (Manganese) IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
SARA 311/312 Hazards Reactivity Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Manganese	7439-96-5	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
H260	In contact with water releases flammable gases which may ignite spontaneously.
H402	Harmful to aquatic life.
H412	Harmful to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	2

NFPA Rating

Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	2
Special hazard.I:	W

Further information

Copyright 2015 Sigma-Aldrich Co. LLC. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

Preparation Information Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.6

Revision Date: 03/02/2015

Print Date: 02/07/2016

MATERIAL SAFETY DATA SHEET

Date Printed: 02.04.2016 Date Updated: 07.08.2012 Version 1.9

Section 1 - Product and Company Information Product Name M-CRESOL APPROX 99% Product Number C5015 Brand SIGMA Company Sigma-Aldrich Address 3050 Spruce Street SAINT LOUIS MO 63103 US Technical Phone: 800-325-5832 Fax: 800-325-5052 Emergency Phone: 314-776-6555 Section 2 - Composition/Information on Ingredient Substance Name CAS # SARA 313 M-CRESOL 108-39-4 Yes Formula C7H8O 3-Cresol * m-Cresol (ACGIH:OSHA) * m-Cresole * Synonyms m-Cresylic acid * 1-Hydroxy-3-methylbenzene * m-Hydroxytoluene * 3-Hydroxytoluene * m-Kresol * m-Methylphenol * 3-Methylphenol * m-Oxytoluene * Phenol, 3-methyl- (9CI) * RCRA waste number U052 * m-Toluol GO6125000 RTECS Number: Section 3 - Hazards Identification EMERGENCY OVERVIEW Toxic. Toxic in contact with skin and if swallowed. Causes burns. Readily absorbed through skin. Combustible. Target organ(s): Central nervous system. Lungs. HMIS RATING HEALTH: 3* FLAMMABILITY: 2 REACTIVITY: 1 NFPA RATING HEALTH: 3 FLAMMABILITY: 2 REACTIVITY: 1 *additional chronic hazards present. For additional information on toxicity, please refer to Section 11.

Section 4 - First Aid Measures

ORAL EXPOSURE If swallowed, wash out mouth with water provided person is conscious. Call a physician immediately. Do not induce vomiting. INHALATION EXPOSURE If inhaled, remove to fresh air. If not breathing give artificial respiration. If breathing is difficult, give oxygen. DERMAL EXPOSURE In case of skin contact, flush with copious amounts of water for at least 15 minutes. Remove contaminated clothing and shoes. Call a physician. EYE EXPOSURE In case of contact with eyes, flush with copious amounts of water for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. Call a physician. Section 5 - Fire Fighting Measures FLASH POINT 186,800 °F 86,000 °C Method: closed cup EXPLOSION LIMITS Lower: 1,060 % Upper: 1,350 % AUTOIGNITION TEMP 558,00 °C FLAMMABILITY N/A EXTINGUISHING MEDIA Suitable: Carbon dioxide, dry chemical powder, or appropriate foam. FIREFIGHTING Protective Equipment: Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Specific Hazard(s): Combustible liquid. Emits toxic fumes under fire conditions. Section 6 - Accidental Release Measures PROCEDURE TO BE FOLLOWED IN CASE OF LEAK OR SPILL Evacuate area. PROCEDURE(S) OF PERSONAL PRECAUTION(S) Wear self-contained breathing apparatus, rubber boots, and heavy rubber gloves. METHODS FOR CLEANING UP Cover with dry lime or soda ash, pick up, keep in a closed container, and hold for waste disposal. Ventilate area and wash spill site after material pickup is complete. Section 7 - Handling and Storage

HANDLING

User Exposure: Do not breathe vapor. Do not get in eyes, on

skin, on clothing. Avoid prolonged or repeated exposure. STORAGE Suitable: Keep tightly closed. Keep away from heat and open flame. Store in a cool dry place. Unsuitable: May discolor on exposure to air and light. Section 8 - Exposure Controls / PPE ENGINEERING CONTROLS Use only in a chemical fume hood. Safety shower and eye bath. PERSONAL PROTECTIVE EQUIPMENT Respiratory: Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Hand: Compatible chemical-resistant gloves. Eye: Chemical safety goggles. Other: Faceshield (8-inch minimum). GENERAL HYGIENE MEASURES Wash contaminated clothing before reuse. Discard contaminated shoes. Wash thoroughly after handling. EXPOSURE LIMITS, RTECS Country Value Source Туре 5 PPM USA ACGIH TWA Remarks: Skin MSHA Standard-air TWA **TISA** 5 PPM (22 MG/M3) **TISA** OSHA. PEL 8H TWA 5 PPM (22 MG/M3) (SKIN) New Zealand OEL Remarks: check ACGIH TLV TWA 2.3 PPM USA NTOSH Section 9 - Physical/Chemical Properties Physical State: Liquid Appearance Value At Temperature or Pressure Property 108,1400 AMU Molecular Weight рΗ N/A BP/BP Range 200,000. - 203,000 ° С. MP/MP Range 8,000. - 10,000 °C. Freezing Point N/A Vapor Pressure < 1,00000000 mmHg 20,00 °C Vapor Density 3,720 g/l Saturated Vapor Conc. N/A 1,0340 g/cm3 SG/Density Bulk Density N/A N/A Odor Threshold N/A Volatile% N/A VOC Content N/A Water Content Solvent Content N/A

Evaporation Rate	N/A	
Viscosity	12,900 Pas	25,000 °C
Surface Tension	N/A	
Partition Coefficient	N/A	
Decomposition Temp.	N/A	
Flash Point	186,800 °F	Method: closed cup
	86,000 °C	
Explosion Limits	Lower: 1,060 %	
	Upper: 1,350 %	
Flammability	N/A	
Autoignition Temp	558,00 °C	
Refractive Index	1,5420	
Optical Rotation	N/A	
Miscellaneous Data	N/A	
Solubility	Other Solvents: SC	LUBLE IN ACETONE, ETHANOL
	MISCIBLE IN ALCOHO	DL,ETHER

N/A = not available

Section 10 - Stability and Reactivity

STABILITY

Stable: Stable. Materials to Avoid: Oxidizing agents, Bases.

HAZARDOUS DECOMPOSITION PRODUCTS Hazardous Decomposition Products: Carbon monoxide, Carbon dioxide.

HAZARDOUS POLYMERIZATION Hazardous Polymerization: Will not occur

Section 11 - Toxicological Information

ROUTE OF EXPOSURE Skin Contact: Causes burns. Skin Absorption: Toxic if absorbed through skin. Readily absorbed through skin.

Eye Contact: Causes burns. Inhalation: May be harmful if inhaled. Material is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. Ingestion: Toxic if swallowed.

TARGET ORGAN(S) OR SYSTEM(S) Central nervous system. Eyes. Liver. Kidneys. Lungs.

SIGNS AND SYMPTOMS OF EXPOSURE Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. Inhalation may result in spasm, inflammation and edema of the larynxand bronchi, chemical pneumonitis, and pulmonary edema. Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting. Exposure can cause: Damage to the eyes. Damage to the kidneys. To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

TOXICITY DATA

Oral Rat 242,000000 mg/kg LD50 Remarks: Behavioral:Somnolence (general depressed activity). Behavioral: Convulsions or effect on seizure threshold. Gastrointestinal:Peritonitis. Inhalation Rat > 710,000 mg/m3 LC50 Skin Rat 1100,000000 mg/kg LD50 Oral Mouse 828,000000 mg/kg LD50 Intraperitoneal Mouse 168 MG/KG LD50 Skin Rabbit 2050,000000 mg/kg LD50 Remarks: Behavioral:Convulsions or effect on seizure threshold. Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Gastrointestinal:Changes in structure or function of salivary glands. IRRITATION DATA Skin Rabbit 517,000000 mg 24H Remarks: Severe irritation effect Eyes Rabbit 103,000000 mg Remarks: Severe irritation effect CHRONIC EXPOSURE - CARCINOGEN Species: Mouse Route of Application: Skin Dose: 2280 MG/KG Exposure Time: 20W Frequency: I Result: Tumorigenic:Neoplastic by RTECS criteria. Skin and Appendages: Other: Tumors.

CHRONIC EXPOSURE - TERATOGEN Species: Rabbit Dose: 134 GM/KG Route of Application: Subcutaneous Exposure Time: (6-18D PREG) Result: Effects on Embryo or Fetus: Fetotoxicity (except death, e.g., stunted fetus). CHRONIC EXPOSURE - MUTAGEN Species: Human Dose: 10 UMOL/L Exposure Time: 4H Cell Type: HeLa cell Mutation test: DNA inhibition Section 12 - Ecological Information ACUTE ECOTOXICITY TESTS Test Type: EC50 Algae Time: 24,0 h Value: 110,000 mg/l Test Type: EC50 Daphnia Species: Daphnia magna Time: 24,0 h Value: 25,000 mg/l Test Type: LC50 Fish Species: Leuciscus idus Time: 48,0 h Value: 17,000. - 19,000 mg/l. Test Type: LC50 Fish Species: Onchorhynchus mykiss (Rainbow trout) Time: 96,0 h Value: 8,900 mg/l Section 13 - Disposal Considerations APPROPRIATE METHOD OF DISPOSAL OF SUBSTANCE OR PREPARATION This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations. Section 14 - Transport Information DOT Proper Shipping Name: Cresols UN#: 2076 Class: 6.1 Packing Group: Packing Group II

Proper Shipping Name: Cresols, liquid (o-, m-, p-)

IATA

Hazard Label: Toxic substances.

Hazard Label: Corrosive

PIH: Not PIH

IATA UN Number: 2076 Hazard Class: 6.1 Packing Group: II

Section 15 - Regulatory Information EU DIRECTIVES CLASSIFICATION Symbol of Danger: T Indication of Danger: Toxic. R: 24/25-34 Risk Statements: Toxic in contact with skin and if swallowed. Causes hurns S: 36/37/39-45 Safety Statements: Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). US CLASSIFICATION AND LABEL TEXT Indication of Danger: Toxic. Risk Statements: Toxic in contact with skin and if swallowed. Causes burns. Safety Statements: In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. Wear suitable protective clothing, gloves, and eye/face protection. In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). US Statements: Readily absorbed through skin. Combustible. Target organ(s): Central nervous system. Lungs. UNITED STATES REGULATORY INFORMATION SARA LISTED: Yes DEMINIMIS: 1,000 % TSCA INVENTORY ITEM: Yes CANADA REGULATORY INFORMATION WHMIS Classification: This product has been classified in accordance with the hazard criteria of the CPR, and the MSDS

Section 16 - Other Information

DISCLAIMER

DSL: Yes NDSL: No

For R&D use only. Not for drug, household or other uses.

contains all the information required by the CPR.

WARRANTY

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Inc., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale. Copyright 2010 Sigma-Aldrich Co. License granted to make unlimitedpaper copies for internal use only.

ERROR: undefined OFFENDING COMMAND: get

STACK:

/quit -dictionary--mark-

Page 1 of 8



MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC. 150 Allen Road Suite 302 Basking Ridge, New Jersey 07920 Information: 1-800-416-2505 Emergency Contact: CHEMTREC 1-800-424-9300 Calls Originating Outside the US: 703-527-3887 (Collect Calls Accepted)

SUBSTANCE: METHYL BROMIDE

TRADE NAMES/SYNONYMS:

MTG MSDS 59; BROMOMETHANE; MBX; METHYL BROMIDE, LIQUID; METHOGAS; ROTOX; BROMOGAS; CELFUME; DOW FUME; DOWFUME MC-2; METAFUME; EMBAFUME; ISCOBROME; PESTMASTER; PROFUME; ZYTOX; HALON 1001; MONOBROMOMETHANE; RCRA U029; UN 1062; Ch3Br; MAT14300; RTECS PA4900000

CHEMICAL FAMILY: halogenated, aliphatic

CREATION DATE: Jan 24 1989 **REVISION DATE:** Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: METHYL BROMIDE CAS NUMBER: 74-83-9 PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=1 REACTIVITY=0

EMERGENCY OVERVIEW: COLOR: colorless PHYSICAL FORM: volatile liquid, gas ODOR: sweet odor MAJOR HEALTH HAZARDS: harmful if inhaled or swallowed, skin irritation, central nervous system depression PHYSICAL HAZARDS: Containers may rupture or explode if exposed to heat.

POTENTIAL HEALTH EFFECTS:





INHALATION:
SHORT TERM EXPOSURE: nausea, vomiting, stomach pain, chest pain, difficulty breathing, headache, symptoms of drunkenness, hyperactivity or drowsiness, tingling sensation, visual disturbances, bluish skin color, paralysis, convulsions, coma
LONG TERM EXPOSURE: fainting, blurred vision, nerve damage, brain damage
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation (possibly severe), itching
LONG TERM EXPOSURE: burns, blisters
EYE CONTACT:
SHORT TERM EXPOSURE: irritation, eye damage
LONG TERM EXPOSURE: irritation, eye damage
LONG TERM EXPOSURE: same as effects reported in short term exposure
INGESTION:
SHORT TERM EXPOSURE: same as effects reported in short term inhalation
LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If swallowed, drink plenty of water, do NOT induce vomiting. Get immediate medical attention. Induce vomiting only at the instructions of a physician. Do not give anything by mouth to unconscious or convulsive person.

NOTE TO PHYSICIAN: For ingestion, consider gastric lavage.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Slight fire hazard. Containers may rupture or explode if exposed to heat.

EXTINGUISHING MEDIA: regular dry chemical, regular foam, water

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Fight large fires from a protected location or safe distance. Stay away from the ends of tanks. Dike for later disposal. Do not scatter



Page 3 of 8

spilled material with high-pressure water streams. Do not attempt to extinguish fire unless flow of material can be stopped first. Use extinguishing agents appropriate for surrounding fire. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Consider downwind evacuation if material is leaking.

LOWER FLAMMABLE LIMIT: 10% **UPPER FLAMMABLE LIMIT:** 16% **AUTOIGNITION:** 999 F (537 C)

6. ACCIDENTAL RELEASE MEASURES

WATER RELEASE:

Subject to California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65). Keep out of water supplies and sewers.

OCCUPATIONAL RELEASE:

Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Small dry spills: Move containers away from spill to a safe area. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Ventilate closed spaces before entering. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Notify State Emergency Response Commission for storage or use at amounts greater than or equal to the TPQ (U.S. EPA SARA Section 302). SARA Section 303 requires facilities storing a material with a TPQ to participate in local emergency response planning (U.S. EPA 40 CFR 355 Part B). Protect from physical damage. Store in a cool, dry place. Store outside or in a detached building. Store in a well-ventilated area. Keep in the dark. Avoid exposure to low temperatures or freezing. Keep separated from incompatible substances.

HANDLING: Subject to handling regulations: U.S. OSHA 29 CFR 1910.119.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS: METHYL BROMIDE: 20 ppm (80 mg/m3) OSHA ceiling (skin) 5 ppm (19 mg/m3) OSHA TWA (skin) (vacated by 58 FR 35338, June 30, 1993)



1 ppm ACGIH TWA (skin) NIOSH TWA (lowest feasible concentration)

VENTILATION: Provide local exhaust or process enclosure ventilation system. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Protective clothing is not required.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

At any detectable concentration -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positivepressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressuredemand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positivepressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressuredemand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: gas APPEARANCE: clear COLOR: colorless PHYSICAL FORM: volatile liquid, gas ODOR: sweet odor TASTE: burning taste MOLECULAR WEIGHT: 95 MOLECULAR FORMULA: C-H3-Br BOILING POINT: 39 F (4 C) FREEZING POINT: -135 F (-93 C) VAPOR PRESSURE: 1250 mmHg @ 20 C VAPOR DENSITY (air=1): 3.3



SPECIFIC GRAVITY (water=1): 1.7 @ 0 C WATER SOLUBILITY: 1.75% @ 20 C PH: Not applicable VOLATILITY: Not applicable ODOR THRESHOLD: Not available EVAPORATION RATE: Not applicable COEFFICIENT OF WATER/OIL DISTRIBUTION: Not applicable SOLVENT SOLUBILITY: Soluble: alcohol, chloroform, ether, benzene, carbon disulfide, carbon tetrachloride

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: metals, combustible materials, oxidizing materials

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: oxides of carbon, acid halides, halides

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

METHYL BROMIDE:

TOXICITY DATA: 302 ppm/8 hour(s) inhalation-rat LC50; 214 mg/kg oral-rat LD50 CARCINOGEN STATUS: IARC: Human Inadequate Evidence, Animal Limited Evidence, Group 3; ACGIH: A4 -Not Classifiable as a Human Carcinogen LOCAL EFFECTS: Irritant: skin ACUTE TOXICITY LEVEL: Toxic: inhalation, ingestion TARGET ORGANS: central nervous system TUMORIGENIC DATA: Available. MUTAGENIC DATA: Available. REPRODUCTIVE EFFECTS DATA: Available. ADDITIONAL DATA: Stimulants such as epinephrine may induce ventricular fibrillation.

12. ECOLOGICAL INFORMATION

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ECOTOXICITY DATA:

FISH TOXICITY: 700 ug/L 96 hour(s) LC50 (Mortality) Medaka, high-eyes (Oryzias latipes)

INVERTEBRATE TOXICITY: 1700 ug/L 48 hour(s) EC50 (Behavior) Water flea (Daphnia magna)

ALGAL TOXICITY: 3200 ug/L 48 hour(s) EC50 (Growth) Green algae (Scenedesmus quadricauda)

ENVIRONMENTAL SUMMARY: Highly toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U029.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101: PROPER SHIPPING NAME: Methyl bromide ID NUMBER: UN1062 HAZARD CLASS OR DIVISION: 2.3 LABELING REQUIREMENTS: 2.3 QUANTITY LIMITATIONS: PASSENGER AIRCRAFT OR RAILCAR: Forbidden CARGO AIRCRAFT ONLY: Forbidden ADDITIONAL SHIPPING DESCRIPTION: Toxic-Inhalation Hazard Zone C



CANADIAN TRANSPORTATION OF DANGEROUS GOODS: SHIPPING NAME: Methyl bromide UN NUMBER: UN1062 CLASS: 2.3

15. REGULATORY INFORMATION

<u>U.S. REGULATIONS:</u> CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): METHYL BROMIDE: 1000 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): METHYL BROMIDE: 1000 LBS TPQ

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C):



METHYL BROMIDE: 1000 LBS RQ

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SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C): ACUTE: Yes CHRONIC: No FIRE: No REACTIVE: No

SUDDEN RELEASE: Yes

SARA TITLE III SECTION 313 (40 CFR 372.65): METHYL BROMIDE

OSHA PROCESS SAFETY (29 CFR 1910.119): METHYL BROMIDE: 2500 LBS TQ

STATE REGULATIONS: California Proposition 65: Known to the state of California to cause the following: METHYL BROMIDE Developmental toxicity (Jan 01, 1993)

CANADIAN REGULATIONS: WHMIS CLASSIFICATION: AD1

NATIONAL INVENTORY STATUS: U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

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ask...The Gas Professionals[™] Page 8 of 8 RESULTING FROM ANY PUBLICATION, USE OR RELIANCE UPON THE INFORMATION HEREIN.



Methyl chloride (Refrigerant gas R 40)

Safety Data Sheet P-4622

Making our planet more productive"

This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication. Date of issue: 01/01/1980

Revision date: 10/17/2016

Supersedes: 10/14/2015

SECTION: 1. Product and company.	identification
1.1. Product identifier	
Product form Name CAS No Formula Other means of identification 1.2. Relevant identified uses of the subs Use of the substance/mixture 1.3. Details of the supplier of the safety	 Substance Methyl chloride (Refrigerant gas R 40) 74-87-3 CH3CI methylchloride, halocarbon 40, monochoromethane stance or mixture and uses advised against Industrial use. Use as directed. data sheet Praxair, Inc. 10 Riverview Drive Danbury, CT 06810-6268 - USA T 1-800-772-9247 (1-800-PRAXAIR) - F 1-716-879-2146 www.praxair.com
1.4. Emergency telephone number	
Emergency number	: Onsite Emergency: 1-800-645-4633 CHEMTREC, 24hr/day 7days/week — Within USA: 1-800-424-9300, Outside USA: 001-703-527-3887 (collect calls accepted, Contract 17729)
SECTION 2: Hazard identification	
2.1. Classification of the substance or m	nixture
GHS-US classification	
Flam. Gas 1H220Liquefied gasH280Acute Tox. 4 (Inhalation:gas)H332Carc. 2H351STOT RE 2H373	
2.2. Label elements	
GHS-US labeling Hazard pictograms (GHS-US)	: GHS02 GHS04 GHS07 GHS08
Signal word (GHS-US)	: DANGER
Hazard statements (GHS-US)	 H220 - EXTREMELY FLAMMABLE GAS H280 - CONTAINS GAS UNDER PRESSURE; MAY EXPLODE IF HEATED H332 - HARMFUL IF INHALED H351 - SUSPECTED OF CAUSING CANCER H373 - MAY CAUSE DAMAGE TO ORGANS (LUNG, KIDNEYS, LIVER, CENTRAL NERVOUS SYSTEM) THROUGH PROLONGED OR REPEATED EXPOSURE CGA-HG04 - MAY FORM EXPLOSIVE MIXTURES WITH AIR CGA-HG01 - MAY CAUSE FROSTBITE
Precautionary statements (GHS-US)	 P201 - Obtain special instructions before use P202 - Do not handle until all safety precautions have been read and understood P210 - Keep away from Heat, Open flames, Sparks, Hot surfaces No smoking P260 - Do not breathe gas

EN (English US)

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Methyl chloride (Refrigerant gas R 40)

Making our planet more productive This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication.

		Vapors can be ig equipment, static point. Explosive a check the atmosp	nited by pilot lights, other flan discharge, or other ignition s atmospheres may linger. Befo ohere with an appropriate dev	nes, smoking, sparks, heaters, electrical ources at locations distant from product handling ore entering an area, especially a confined area, rice.
Fire haz	ard	: EXTREMELY FL flames, Flammab	AMMABLE GAS. If venting of le vapors may spread from le	or leaking gas catches fire, do not extinguish eak, creating an explosive reignition hazard.
5.2.	Special hazards arising fro	surrounding fire.		
Suitable	extinguishing media	: Carbon dioxide, I	Dry chemical, Water spray or	fog. Use extinguishing media appropriate for
5.1.	Extinguishing media			
SECT	ON 5: Firefighting meas	sures		
Obtain r	nedical assistance.			
4.3.	Indication of any immediate	e medical attention and spec	ial treatment needed	
		No additional info	rmation available	
4.2.	Most important symptoms	and effects, both acute and o	lelayed	
First-aic	measures after ingestion	: Ingestion is not c	onsidered a potential route of	exposure.
First-aic	measures after eye contact	: Immediately flush away from the ey ophthalmologist i	eyes thoroughly with water f eballs to ensure that all surfa mmediately.	or at least 15 minutes. Hold the eyelids open and ces are flushed thoroughly. Contact an
First-aic	I measures after skin contact	: The liquid may ca warm water not to skin. Maintain sk returned to the af with warm water.	ause frostbite. For exposure to b exceed 105°F (41°C). Wate in warming for at least 15 min fected area. In case of massi Seek medical evaluation and	o liquid, immediately warm frostbite area with er temperature should be tolerable to normal nutes or until normal coloring and sensation have ve exposure, remove clothing while showering I treatment as soon as possible.
First-aic	I measures after inhalation	: Remove to fresh give artificial resp physician.	air and keep at rest in a posit iration. If breathing is difficult	ion comfortable for breathing. If not breathing, , trained personnel should give oxygen. Call a
4.1.	Description of first aid mea	sures		
SECT	ON 4: First aid measure	es		
Not app	licable			
3.2.	Mixture	·		
Methyl (Main co	chloride (Refrigerant gas R 40)	(CAS No) 74-87-3	100	
Name		Product identifie	er %	
3.1.	Substance			
SECT	ION 3: Composition/Info	ormation on ingredients	3	
		No data available		
2.4.	Unknown acute toxicity (Gl	HS US)		
classific	ation	. Contact with iqui		one.
2.3. Other b	other hazards	· Contact with liqui	d may cause cold hume/frost	hite
		CGA-PG06 - Clos CGA-PG02 - Pro	se valve after each use and v tect from sunlight when ambi-	/hen empty ent temperature exceeds 52°C (125°F)
		CGA-PG05 - Use CGA-PG12 - Do	not open valve until connecte	d to equipment prepared for use
		P501 - Dispose o	f contents/container in accord	dance with container Supplier/owner instructions
		P381 - Eliminate P405 - Store lock	all ignition sources if safe to a	do so
		and/or face prote P377 - Leaking g	ction as fire: Do not extinguish, unl	ess leak can be stopped safely
		P280+P284 - We	ar protective gloves, protectiv	ve clothing, eye protection, respiratory protection,
		P262 - Do not ge	t in eyes, on skin, or on clothi	ng
		Date of issue: 01/01/1980	Revision date: 10/17/2016	Supersedes: 10/14/2015

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Methyl chloride (Refrigerant gas R 40)

Safety Data Sheet P-4622

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Explosic	on hazard	: EXTREMELY FLAMMABLE GAS. Forms explosive mixtures with air and oxidizing agents.
Reactivi	ty	: No reactivity hazard other than the effects described in sub-sections below.
5.3.	Advice for firefighters	
Firefight	ing instructions	: DANGER! Toxic, flammable liquefied gas
		Evacuate all personnel from the danger area. Use self-contained breathing apparatus (SCBA) and protective clothing. Immediately cool containers with water from maximum distance. Stop flow of gas if safe to do so, while continuing cooling water spray. Remove ignition sources if safe to do so. Remove containers from area of fire if safe to do so. On-site fire brigades must comply with OSHA 29 CFR 1910.156 and applicable standards under 29 CFR 1910 Subpart L—Fire Protection.
Special	protective equipment for fire fighters	: Standard protective clothing and equipment (Self Contained Breathing Apparatus) for fire fighters.
Other in	formation	: Containers are equipped with a pressure relief device. (Exceptions may exist where authorized by DOT.).
SECT	ON 6: Accidental release mea	isures
6.1.	Personal precautions, protective ed	quipment and emergency procedures
General	measures	DANGER: Flammable, liquefied gas. FORMS EXPLOSIVE MIXTURES WITH AIR. Immediately evacuate all personnel from danger area. Use self-contained breathing apparatus where needed. Remove all sources of ignition if safe to do so. Reduce vapors with fog or fine water spray, taking care not to spread liquid with water. Shut off flow if safe to do so. Ventilate area or move container to a well-ventilated area. Flammable vapors may spread from leak and could explode if reignited by sparks or flames. Explosive atmospheres may linger. Before entering area, especially confined areas, check atmosphere with an appropriate device.
6.1.1.	For non-emergency personnel	No additional information available
6.1.2.	For emergency responders	No additional information available
6.2.	Environmental precautions	
		Prevent waste from contaminating the surrounding environment. Prevent soil and water pollution Dispose of contents/container in accordance with local/regional/national/international regulations. Contact supplier for any special requirements.
6.3.	Methods and material for containm	ent and cleaning up
		No additional information available
6.4.	Reference to other sections	
		See also sections 8 and 13.
SECT	ON 7: Handling and storage	
7.1.	Precautions for safe handling	
Precaut	ons for safe handling	: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking. Use only non-sparking tools. Use only explosion-proof equipment
		Wear leather safety gloves and safety shoes when handling cylinders. Protect cylinders from physical damage; do not drag, roll, slide or drop. While moving cylinder, always keep in place removable valve cover. Never attempt to lift a cylinder by its cap; the cap is intended solely to protect the valve. When moving cylinders, even for short distances, use a cart (trolley, hand truck, etc.) designed to transport cylinders. Never insert an object (e.g, wrench, screwdriver, pry bar) into cap openings; doing so may damage the valve and cause a leak. Use an adjustable strap wrench to remove over-tight or rusted caps. Slowly open the valve. If the valve is hard to open, discontinue use and contact your supplier. Close the container valve after each use; keep closed even when empty. Never apply flame or localized heat directly to any part of the container. High temperatures may damage the container and could cause the pressure relief device to fail prematurely, venting the container contents. For other precautions in using this product, see section 16.



Methyl chloride (Refrigerant gas R 40) Safety Data Sheet P-4622

This SDS conforms to U.S. Code of Federal Regulations 29 CFR 1910.1200, Hazard Communication. Revision date: 10/17/2016

Date of issue: 01/01/1980

Supersedes: 10/14/2015

Conditions for safe storage, including any incompatibilities 7.2.

Storage conditions : Store only where temperature will not exceed 125°F (52°C). Post "No Smoking/No Open Flames" signs in storage and use areas. There must be no sources of ignition. Separate packages and protect against potential fire and/or explosion damage following appropriate codes and requirements (e.g, NFPA 30, NFPA 55, NFPA 70, and/or NFPA 221 in the U.S.) or according to requirements determined by the Authority Having Jurisdiction (AHJ). Always secure containers upright to keep them from falling or being knocked over. Install valve protection cap, if provided, firmly in place by hand when the container is not in use. Store full and empty containers separately. Use a first-in, first-out inventory system to prevent storing full containers for long periods. For other precautions in using this product, see section 16 OTHER PRECAUTIONS FOR HANDLING, STORAGE, AND USE: When handling product under pressure, use piping and equipment adequately designed to withstand the pressures to be encountered. Never work on a pressurized system. Use a back flow preventive device in the piping. Gases can cause rapid suffocation because of oxygen deficiency; store and use with adequate ventilation. If a leak occurs, close the container valve and blow down the system in a safe and environmentally correct manner in compliance with all international, federal/national, state/provincial, and local laws; then repair the leak. Never place a container where it may

become part of an electrical circuit.

Specific end use(s) 7.3

None.

SECTION 8: Exposure controls/personal protection Control poromotors

orni ooninoi parametero			
Methyl chloride (Refrigerant gas R 40) (74-87-3)			
ACGIH	ACGIH TLV-TWA (ppm)	50 ppm	
ACGIH	ACGIH TLV-STEL (ppm)	100 ppm	
USA OSHA	OSHA PEL (TWA) (ppm)	100 ppm	
USA OSHA	OSHA PEL (Ceiling) (ppm)	200 ppm	
USA IDLH	US IDLH (mg/m ³)	≈ mg/m ³	
USA IDLH	US IDLH (ppm)	2000 ppm	

Exposure controls 8.2. Appropriate engineering controls : Use an explosion-proof local exhaust system. Local exhaust and general ventilation must be adequate to meet exposure standards. MECHANICAL (GENERAL): Inadequate - Use only in a closed system. Use explosion proof equipment and lighting. A canopy-type, forced-draft fume hood is preferred. Wear safety glasses when handling cylinders; vapor-proof goggles and a face shield during Eye protection cylinder changeout or whenever contact with product is possible. Select eye protection in accordance with OSHA 29 CFR 1910.133. Skin and body protection Wear metatarsal shoes and work gloves for cylinder handling, and protective clothing where needed. Wear appropriate chemical gloves during cylinder changeout or wherever contact with product is possible. Select per OSHA 29 CFR 1910.132, 1910.136, and 1910.138.

- : When workplace conditions warrant respirator use, follow a respiratory protection program that Respiratory protection meets OSHA 29 CFR 1910.134, ANSI Z88.2, or MSHA 30 CFR 72.710 (where applicable). Use an air-supplied or air-purifying cartridge if the action level is exceeded. Ensure that the respirator has the appropriate protection factor for the exposure level. If cartridge type respirators are used, the cartridge must be appropriate for the chemical exposure. For emergencies or instances with unknown exposure levels, use a self-contained breathing apparatus (SCBA).
- Wear cold insulating gloves when transfilling or breaking transfer connections. Thermal hazard protection

SECTION 9: Physical and chemical p	roperties	
9.1. Information on basic physical and ch	nemical properties	
Physical state	: Gas	
Appearance	: Colorless gas.	
Molecular mass	: 50.5 g/mol	
Color	: Colorless.	
EN (English US)	SDS ID: P-4622	4/9

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Safety Data Sheet P-4622

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Odor	: Sweetish. Ethereal.
Odor threshold	: < 0.01 ppm
рН	: Not applicable.
Relative evaporation rate (butyl acetate=1)	: No data available
Relative evaporation rate (ether=1)	: Not applicable.
Melting point	: -97.7 °C (-143.86°F)
Freezing point	: No data available
Boiling point	: -24.2 °C (-11.6°F)
Flash point	: Not applicable.
Critical temperature	: 143.1 °C (289.6°F)
Auto-ignition temperature	: 632 °C (1170°F)
Decomposition temperature	: No data available
Flammability (solid, gas)	: 8.1 - 17.4 vol %
Vapor pressure	: 5.1 bar (73.4 psia)(@21.1°C/70°F)
Critical pressure	: 66.5 bar (966 psia)
Relative vapor density at 20 °C	: No data available
Relative density	: 0.92 (at 20°C/68°F)
Density	: 0.921 g/cm ³ (at 20 °C)
Relative gas density	: 1.743 (at 21.1°C/70°F, 1 atm)
Solubility	: Water: 6310 mg/l
Log Pow	: 0.91
Log Kow	: Not applicable.
Viscosity, kinematic	: Not applicable.
Viscosity, dynamic	: Not applicable.
Explosive properties	: Not applicable.
Oxidizing properties	: None.
Explosion limits	: No data available
9.2. Other information	
Gas group	: Liquefied gas
Additional information	: Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level

SECTI	ON 10: Stability and reactivity	
10.1.	Reactivity	
		No reactivity hazard other than the effects described in sub-sections below.
10.2.	Chemical stability	
		Stable under normal conditions.
10.3.	Possibility of hazardous reactions	
		May occur.
10.4.	Conditions to avoid	
		Avoid temperature above 752°F (400°C).
10.5.	Incompatible materials	
		May react with aluminium. Reaction with aluminum may form pyrophoric trimethyl aluminum or aluminum alkyls. Oxidizing agents. Magnesium. Zinc. Potassium. Sodium. Aluminum chloride. Ethylene. Moisture. Rubber.
10.6.	Hazardous decomposition products	
		Carbon dioxide. Carbon monoxide. Chlorine. On heating/burning: release of toxic and corrosive gases/vapors hydrogen chloride : formation of small quantities of phosgene.

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Supersedes: 10/14/2015

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11.1. Information on toxicological effects

Methyl chloride (Refrigerant gas R 40) (\f)74-87-3	
LD50 oral rat 1800 m	g/kg
LC50 inhalation rat (mg/l) 5300 m	g/m³ (Exposure time: 4 h)
LC50 inhalation rat (ppm) 8300 pp	m/1h
ATE US (oral) 1800.00	0 mg/kg body weight
ATE US (gases) 8300.00	0 ppm/1h
Skin corrosion/irritation : Not class	ified
pH: Not a	pplicable.
Serious eye damage/irritation : Not class	ified
pH: Not a	pplicable.
Respiratory or skin sensitization : Not class	ified
Germ cell mutagenicity : Not class	ified
Carcinogenicity : SUSPEC	TED OF CAUSING CANCER.
Methyl chloride (Refrigerant gas R 40) (74-87-3)	
IARC group 3 - Not	classifiable
Reproductive toxicity : Not cla	sified
Specific target organ toxicity (single exposure) . Not cla	sified
Specific target organ toxicity (repeated : MAY C system)	AUSE DAMAGE TO ORGANS (LUNG, KIDNEYS, LIVER, CENTRAL NERVOUS M) THROUGH PROLONGED OR REPEATED EXPOSURE.
Aspiration hazard : Not cla	sified
SECTION 12: Ecological information	
12.1. Toxicity	
Ecology - general : No kno	vn ecological damage caused by this product.
Methyl chloride (Refrigerant gas R 40) (74-87-3)	
LC50 fish 1 550 mg	I (Exposure time: 96 h - Species: Lepomis macrochirus [static])
12.2. Persistence and degradability	
Methyl chloride (Refrigerant gas R 40) (74-87-3)	
Persistence and degradability The sub	stance is biodegradable. Unlikely to persist.
12.3. Bioaccumulative potential	
Methyl chloride (Refrigerant gas R 40) (74-87-3)	
Log Pow 0.91	
Log Kow Not app	licable.
Bioaccumulative potential Not exp	ected to bioaccumulate due to the low log Kow (log Kow < 4). Refer to section 9.
12.4. Mobility in soil	
Methyl chloride (Refrigerant gas R 40) (74-87-3)	
Mobility in soil No data	available.
Ecology - soil Becaus	e of its high volatility, the product is unlikely to cause ground or water pollution.
12.5. Other adverse effects	
Other adverse effects : May ca	use pH changes in aqueous ecological systems.
Effect on ozone layer : None	
Global warming potential [CO2=1] : 13	
Effect on the global warming : Contain	s Fluorinated greenhouse gases covered by the Kyoto protocol
EN (English US)	SDS ID: P-4622 6/4

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SECTION 13: Disposal considerations	
13.1. Waste treatment methods	
Regional legislation (waste) :	U.S RCRA (Resource Conservation & Recovery Act) - Basis for Listing - Appendix VII. U.S RCRA (Resource Conservation & Recovery Act) - Constituents for Detection Monitoring. U.S RCRA (Resource Conservation & Recovery Act) - Hazardous Constituents - Appendix VIII to 40 CFR 261. U.S RCRA (Resource Conservation & Recovery Act) - List for Hazardous Constituents. U.S RCRA (Resource Conservation & Recovery Act) - Part 268 Appendix III - Halogenated Organic Compounds (HOCs). U.S RCRA (Resource Conservation & Recovery Act) - Phase 4 LDR Rule - Universal Treatment Standards. U.S RCRA (Resource Conservation & Recovery Act) - TSD Facilities Ground Water Monitoring. U.S RCRA (Resource Conservation & Recovery Act) - U Series Wastes - Acutely Toxic Wastes & Other Hazardous Characteristics.
Waste disposal recommendations :	Do not attempt to dispose of residual or unused quantities. Return container to supplier.
SECTION 14: Transport information	
In accordance with DOT	
Transport document description :	UN1063 Methyl chloride, 2.1
UN-No.(DOT) :	UN1063
Proper Shipping Name (DOT) :	Methyl chloride
Class (DOT) :	2.1 - Class 2.1 - Flammable gas 49 CFR 173.115
Hazard labels (DOT) :	2.1 - Flammable gas
DOT Special Provisions (49 CFR 172.102) :	N86 - UN pressure receptacles made of aluminum alloy are not authorized T50 - When portable tank instruction T50 is referenced in Column (7) of the 172.101 Table, the applicable liquefied compressed gases are authorized to be transported in portable tanks in accordance with the requirements of 173.313 of this subchapter
Additional information	
Emergency Response Guide (ERG) Number :	115
Other information :	No supplementary information available.
Special transport precautions :	Avoid transport on vehicles where the load space is not separated from the driver's compartment. Ensure vehicle driver is aware of the potential hazards of the load and knows what to do in the event of an accident or an emergency. Before transporting product containers: - Ensure there is adequate ventilation Ensure that containers are firmly secured Ensure cylinder valve is closed and not leaking Ensure valve outlet cap nut or plug (where provided) is correctly fitted Ensure valve protection device (where provided) is correctly fitted.
Transport by sea	
UN-No. (IMDG) :	1063
Proper Shipping Name (IMDG) :	METHYL CHLORIDE (REFRIGERANT GAS R 40)
Class (IMDG) :	2 - Gases
MFAG-No :	115
Air transport	
UN-No. (IATA) :	1063
Proper Shipping Name (IATA) :	Methyl chloride
Class (IATA) :	2
Civil Aeronautics Law :	Gases under pressure/Gases flammable under pressure

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SECTION 15: Regulatory information		
15.1. US Federal regulations		
Methyl chloride (Refrigerant gas R 40) (74-87-3		
Listed on the United States TSCA (Toxic Substances Control Act) inventory		
Subject to reporting requirements of United States SARA Section 313		
CERCLA RQ 100 lb		
SARA Section 311/312 Hazard Classes	Immediate (acute) health hazard Delayed (chronic) health hazard Sudden release of pressure hazard Fire hazard	
SARA Section 313 - Emission Reporting	1.0 %	

15.2. International regulations

CANADA

Methyl chloride (Refrigerant gas R 40) (74-87-3)	
Listed on the Canadian DSL (Domestic Substances List)	

EU-Regulations

Methyl chloride (Refrigerant gas R 40) (74-87-3)

Listed on the EEC inventory EINECS (European Inventory of Existing Commercial Chemical Substances)

15.2.2. National regulations

Methyl chloride (Refrigerant gas R 40) (74-87-3)
Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on IECSC (Inventory of Existing Chemical Substances Produced or Imported in China)
Listed on the Japanese ENCS (Existing & New Chemical Substances) inventory
Listed on the Korean ECL (Existing Chemicals List)
Listed on NZIoC (New Zealand Inventory of Chemicals)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)
Japanese Poisonous and Deleterious Substances Control Law
Japanese Pollutant Release and Transfer Register Law (PRTR Law)
Listed on the Canadian IDL (Ingredient Disclosure List)
Listed on INSQ (Mexican National Inventory of Chemical Substances)

15.3. US State regulations

Methyl chloride (Refrigerant gas R 40)(74-87-3)	
U.S California - Proposition 65 - Carcinogens List	No
U.S California - Proposition 65 - Developmental Toxicity	Yes
U.S California - Proposition 65 - Reproductive Toxicity - Female	No
U.S California - Proposition 65 - Reproductive Toxicity - Male	Yes
State or local regulations	U.S Massachusetts - Right To Know List U.S New Jersey - Right to Know Hazardous Substance List U.S Pennsylvania - RTK (Right to Know) - Environmental Hazard List U.S Pennsylvania - RTK (Right to Know) List

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SECTION 16: Other information	
Other information	: When you mix two or more chemicals, you can create additional, unexpected hazards. Obtain and evaluate the safety information for each component before you produce the mixture. Consult an industrial hygienist or other trained person when you evaluate the end product. Before using any plastics, confirm their compatibility with this product
	Praxair asks users of this product to study this SDS and become aware of the product hazards and safety information. To promote safe use of this product, a user should (1) notify employees, agents, and contractors of the information in this SDS and of any other known product hazards and safety information, (2) furnish this information to each purchaser of the product, and (3) ask each purchaser to notify its employees and customers of the product hazards and safety information
	The opinions expressed herein are those of qualified experts within Praxair, Inc. We believe that the information contained herein is current as of the date of this Safety Data Sheet. Since the use of this information and the conditions of use are not within the control of Praxair, Inc, it is the user's obligation to determine the conditions of safe use of the product
	Praxair SDSs are furnished on sale or delivery by Praxair or the independent distributors and suppliers who package and sell our products. To obtain current SDSs for these products, contact your Praxair sales representative, local distributor, or supplier, or download from www.praxair.com. If you have questions regarding Praxair SDSs, would like the document number and date of the latest SDS, or would like the names of the Praxair suppliers in your area, phone or write the Praxair Call Center (Phone: 1-800-PRAXAIR/1-800-772-9247; Address: Praxair Call Center, Praxair, Inc, P.O. Box 44, Tonawanda, NY 14151-0044)
	PRAXAIR and the Flowing Airstream design are trademarks or registered trademarks of Praxair Technology, Inc. in the United States and/or other countries.
NFPA health hazard :	2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is given.
NFPA fire hazard :	4 - Will rapidly or completely vaporize at normal pressure and temperature, or is readily dispersed in air and will burn readily.
NFPA reactivity :	1 - Normally stable, but can become unstable at elevated temperatures and pressures or may react with water with some release of energy, but not violently.
HMIS III Rating	
Health	: 2 Moderate Hazard - Temporary or minor injury may occur

 Flammability
 : 4 Severe Hazard

 Physical
 : 2 Moderate Hazard

SDS US (GHS HazCom 2012) - Praxair

This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.



Part of Thermo Fisher Scientific

SAFETY DATA SHEET

Creation Date 27-Jan-2010	Revision Date 02-Oct-2015	Revision Number 2
	1. Identification	
Product Name	Methylene chloride	
Cat No. :	D37-1; D37-4; D37-20; D37-200; D37-200LC; D37FB-50; D37FB-115; D37FB-200; D37POF D37POPB-200; D37RB-19; D37RB-50; D37R D37RS-19; D37RS-28; D37RS-50; D37RS-11 D37SK-4LC; D37SS-28; D37SS-50; D37SS-1 D37SS-1350	; D37-500; D37FB-19; P-19; D37POPB-50; RB-115; D37RB-200; I5; D37RS-200; D37SK-4; I15; D37SS-200;
Synonyms	Dichloromethane; DCM	
Recommended Use	Laboratory chemicals.	
Uses advised against Details of the supplier of the sa	No Information available fety data sheet	
Company Fisher Scientific One Reagent Lane	Emergency Telephone Number CHEMTREC®, Inside the USA: 800-424-9300 CHEMTREC®, Outside the USA: 001-703-527-3887	

Fair Lawn, NJ 07410 Tel: (201) 796-7100

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1E
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Central nervous system (CNS), Respirat	ory system.
Specific target organ toxicity - (repeated exposure)	Category 2
Target Organs - Liver, Kidney, Blood.	

Label Elements

Signal Word Danger

Hazard Statements

Causes skin irritation Causes serious eye irritation May cause respiratory irritation May cause drowsiness or dizziness May cause cancer May cause damage to organs through prolonged or repeated exposure



Precautionary Statements Prevention

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Use personal protective equipment as required

Wash face, hands and any exposed skin thoroughly after handling

Wear eye/face protection

Do not breathe dust/fume/gas/mist/vapors/spray

Use only outdoors or in a well-ventilated area

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water

If skin irritation occurs: Get medical advice/attention

Take off contaminated clothing and wash before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention

Storage

Store locked up

Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

WARNING! This product contains a chemical known in the State of California to cause cancer, birth defects or other reproductive harm.

3. Composition / information on ingredients

Component	CAS-No	Weight %
Methylene chloride	75-09-2	>99.5
Methyl alcohol	67-56-1	0 - 0.4
Cyclohexene	110-83-8	0 - 0.01
2-Methyl-2-butene	513-35-9	0 - 0.01

4. First-aid measures		
General Advice	If symptoms persist, call a physician.	
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.	
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.	

Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms/effects	Breathing difficulties. Inhalation of high vapor concentrations may cause symptoms like
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
Unsuitable Extinguishing Media	No information available
Flash Point Method -	No information available No information available
Autoignition Temperature Explosion Limits	556 °C / 1032.8 °F
Upper	23 vol %
Lower	13 vol %
Sensitivity to Mechanical Impac Sensitivity to Static Discharge	t No information available No information available

Specific Hazards Arising from the Chemical

Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂) Hydrogen chloride gas Phosgene

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

<u>NFPA</u>

Health 2	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental rel	ease measures	
Personal Precautions	Use personal protective eq eyes and clothing. Keep pe	uipment. Ensure adequate ven ople away from and upwind of	tilation. Avoid contact with skin, spill/leak.
Environmental Precautions	Should not be released into information.	the environment. See Section	12 for additional ecological

Methods for Containment and Clean Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Up

	7. Handling and storage
Handling	Wear personal protective equipment. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Use only under a chemical fume hood.

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Methylene chloride	TWA: 50 ppm	(Vacated) TWA: 500 ppm (Vacated) STEL: 2000 ppm (Vacated) Ceiling: 1000 ppm TWA: 25 ppm STEL: 125 ppm	IDLH: 2300 ppm
Methyl alcohol	TWA: 200 ppm STEL: 250 ppm Skin	(Vacated) TWA: 200 ppm (Vacated) TWA: 260 mg/m ³ (Vacated) STEL: 250 ppm (Vacated) STEL: 325 mg/m ³ Skin TWA: 200 ppm TWA: 260 mg/m ³	IDLH: 6000 ppm TWA: 200 ppm TWA: 260 mg/m ³ STEL: 250 ppm STEL: 325 mg/m ³
Cyclohexene	TWA: 300 ppm	(Vacated) TWA: 300 ppm (Vacated) TWA: 1015 mg/m ³ TWA: 300 ppm TWA: 1015 mg/m ³	IDLH: 2000 ppm TWA: 300 ppm TWA: 1015 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Methylene chloride	TWA: 50 ppm TWA: 174 mg/m³	TWA: 100 ppm TWA: 330 mg/m ³ STEL: 500 ppm STEL: 1740 mg/m ³	TWA: 50 ppm
Methyl alcohol	TWA: 200 ppm TWA: 262 mg/m ³ STEL: 250 ppm STEL: 328 mg/m ³ Skin	TWA: 200 ppm TWA: 260 mg/m ³ STEL: 250 ppm STEL: 310 mg/m ³	TWA: 200 ppm STEL: 250 ppm Skin
Cyclohexene	TWA: 300 ppm TWA: 1010 mg/m ³	TWA: 300 ppm TWA: 1015 mg/m ³	TWA: 300 ppm

Legend

ACGIH - American Conference of Governmental Industrial Hygienists OSHA - Occupational Safety and Health Administration NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures	Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties		
Physical State	Liquid	
Appearance	Coloriess	
Odor	sweet	
Odor Threshold	No information available	
рН	Not applicable	
Melting Point/Range	-97 °C / -142.6 °F	
Boiling Point/Range	39 °C / 102.2 °F	
Flash Point	No information available	

Evaporation Rate Flammability (solid,gas) Flammability or explosive limits Upper Lower Vapor Pressure Vapor Density Specific Gravity Solubility Partition coefficient; n-octanol/water Autoignition Temperature Decomposition Temperature Viscosity Molecular Formula Molecular Weight Revision Date 02-Oct-2015

No information available Not applicable 23 vol % 13 vol % 20 mmHg @ 3502°C 2.93 (Air = 1.0) 1.33 No information available No data available 556 °C / 1032.8 °F No information available No information available No information available C H2 Cl2 84.93

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat.
Incompatible Materials	Strong oxidizing agents, Strong acids, Amines
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO2), Hydrogen chloride gas, Phosgene
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component	LD50 Oral		D50 Dermal	LC50	Inhalation		
Methylene chloride	> 2000 mg/kg (Rat)	> 2000 mg/kg (Rat) 53 mg/L (Rat) 6 h 76000 mg/m³ (Rat) 4 h					
Methyl alcohol	LD50 = 6200 mg/kg(Rat)	LD50 = 15800 mg/kg (Rabbit) 64000 ppm (Rat) 4 h 83.2 mg/L (Rat) 4 h					
Cyclohexene	LD50 = 2400 µL/kg (Rat)	>2	:00 mg/kg (Rat)	>21.6 r	>21.6 mg/L/4h (rat)		
2-Methyl-2-butene	700-2600 mg/kg (Rat)	>20	00 mg/kg (Rat)	LC50 > 6100	0 ppm (Rat)4 h		
Toxicologically Synergistic Products Delayed and immediate effects	No information available as well as chronic effects from	m short an	d long-term expo	osure_			
Irritation	Irritating to eyes and skin	Irritating to eyes and skin					
Sensitization	No information available	No information available					
Carcinogenicity	nogenicity The table below indicates whether each agency has listed any ingredient as a carcinoger				as a carcinogen.		
			100111				

Component	CAS-NO	IARC	NIP	ACGIH	USHA	IVIEXICO
Methylene chloride	75-09-2	Group 2A	Reasonably Anticipated	A3	Х	A3
Methyl alcohol	67-56-1	Not listed	Not listed	Not listed	Not listed	Not listed

Cyclohexene	110-83-8	Not listed	Not listed	Not listed	Not listed	Not listed	
2-Methyl-2-butene	513-35-9	Not listed	Not listed	Not listed	Not listed	Not listed	
IARC: (Internationa NTP: (National Tox	al Agency for Rese ricity Program)	earch on Cancer)	IARC: (Inter Group 1 - C Group 2A - Group 2B - NTP: (Natio Known - Kn Reasonably	national Agency for I arcinogenic to Huma Probably Carcinoger Possibly Carcinogen nal Toxicity Program own Carcinogen • Anticipated - Reaso	Research on Cancer, ns nic to Humans ic to Humans) nably Anticipated to 1) be a Human	
ACGIH: (American Hygienists)	n Conference of Go	overnmental Industr	Carcinogen ial A1 - Known A2 - Suspec A3 - Animal ACGIH: (A)	Human Carcinogen cted Human Carcinog Carcinogen merican Conference	gen of Governmental Ind	ustrial Hvoienists)	
Mexico - Occupatio	onal Exposure Lim	its - Carcinogens	- Carcinogens Mexico - Occupational Exposure Limits - Carcinogens A1 - Confirmed Human Carcinogen A2 - Suspected Human Carcinogen A3 - Confirmed Animal Carcinogen A4 - Not Classifiable as a Human Carcinogen A5 - Not Suspected as a Human Carcinogen				
Mutagenic Effects Mutagenic effects have occured in microorganisms.							
Reproductive Effects	5	Experiments have	shown reproductiv	ve toxicity effects o	n laboratory anima	ıls.	
Developmental Effect	sts	Developmental effects have occurred in experimental animals.					
Teratogenicity		No information available.					
STOT - single expos STOT - repeated exp	ure osure	Central nervous system (CNS) Respiratory system Liver Kidney Blood					
Aspiration hazard		No information ava	ailable				
Symptoms / effects, delayed Endocrine Disruptor	both acute and Information	Inhalation of high v tiredness, nausea No information ava	vapor concentration and vomiting ailable	ns may cause sym	ptoms like headac	he, dizziness,	
Other Adverse Effec	ts	Tumorigenic effect RTECS for comple	ts have been repor	ted in experimenta	I animals. See act	ual entry in	

12. Ecological information

Ecotoxicity

.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Methylene chloride	EC50:>660 mg/L/96h	Pimephales promelas: LC50:193 mg/L/96h	EC50: 1 mg/L/24 h EC50: 2.88 mg/L/15 min	EC50: 140 mg/L/48h
Methyl alcohol	Not listed	Pimephales promelas: LC50 > 10000 mg/L 96h	EC50 = 39000 mg/L 25 min EC50 = 40000 mg/L 15 min EC50 = 43000 mg/L 5 min	EC50 > 10000 mg/L 24h
Cyclohexene	Not listed	Poecillia reticulata: 7.1 mg/L/96h	Not listed	Daphnia: EC50: 5.3 mg/L/48h
2-Methyl-2-butene	Not listed	Not listed	Not listed	EC50: = 3 mg/L, 48h (Daphnia magna)

Persistence and Degradability Bioaccumulation/ Accumulation

Persistence is unlikely based on information available. No information available.

Mobility

Will likely be mobile in the environment due to its volatility.

Component	log Pow
Methylene chloride	1.25
Methyl alcohol	-0.74

Cyclohexene

13. Disposal considerations

Waste Disposal Methods

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

3.27

Component	RCRA - U Series Wastes	RCRA - P Series Wastes
Methylene chloride - 75-09-2	U080	-
Methyl alcohol - 67-56-1	U154	-

	14. Transport information
DOT	
UN-No	UN1593
Proper Shipping Name	DICHLOROMETHANE
Hazard Class	6.1
Packing Group	
TDG	
UN-No	UN1593
Proper Shipping Name	DICHLOROMETHANE
Hazard Class	6.1
Packing Group	
IATA	
UN-No	UN1593
Proper Shipping Name	Dichloromethane
Hazard Class	6.1
Packing Group	
IMDG/IMO	
UN-No	UN1593
Proper Shipping Name	Dichloromethane
Hazard Class	6.1
Packing Group	
	15 Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Methylene chloride	Х	Х	-	200-838-9	-		Х	Х	Х	Х	Х
Methyl alcohol	Х	Х	-	200-659-6	-		Х	Х	Х	Х	Х
Cyclohexene	Х	Х	-	203-807-8	-		Х	Х	Х	Х	Х
2-Methyl-2-butene	Х	Х	-	208-156-3	-		Х	Х	Х	Х	Х

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Methylene chloride	75-09-2	>99.5	0.1
Methyl alcohol	67-56-1	0 - 0.4	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Methylene chloride	-	-	Х	Х

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Methylene chloride	Х		-
Methyl alcohol	Х		-

OSHA Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Methylene chloride	125 ppm STEL	-
	12.5 ppm Action Level	
	25 ppm TWA	

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Methylene chloride	1000 lb 1 lb	-
Methyl alcohol	5000 lb	-

California Proposition 65 This product contains the following proposition 65 chemicals

CAS-No	California Prop. 65	Prop 65 NSRL	Category
75-09-2	Carcinogen	200 µg/day 50 µg/day	Carcinogen
67-56-1	Developmental	-	Developmental
	75-09-2 67-56-1	CAS-NO California Prop. 65 75-09-2 Carcinogen 67-56-1 Developmental	CAS-NO California Prop. 65 Prop 65 NSRL 75-09-2 Carcinogen 200 µg/day 50 µg/day 67-56-1 Developmental -

U.S. State Right-to-Know Regulations

Regulations					
Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Methylene chloride	Х	Х	Х	Х	Х
Methyl alcohol	Х	Х	Х	Х	Х
Cyclohexene	Х	Х	Х	-	Х
2-Methyl-2-butene	Х	Х	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Υ
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D1B Toxic materials D2A Very toxic materials



Prepared By

16. Other information Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

Creation Date Revision Date Print Date Revision Summary 27-Jan-2010 02-Oct-2015 02-Oct-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



Division of Facilities Services

DOD Hazardous Material Information (ANSI Format) For Cornell University Convenience Only

METHYL TERTIARY BUTYL ETHER

Section 1 - Product and Company Identification	Section 9 - Physical & Chemical Properties
Section 2 - Compositon/Information on Ingredients	Section 10 - Stability & Reactivity Data
Section 3 - Hazards Identification Including Emergency Overview	Section 11 - Toxicological Information
Section 4 - First Aid Measures	Section 12 - Ecological Information
Section 5 - Fire Fighting Measures	Section 13 - Disposal Considerations
Section 6 - Accidental Release Measures	Section 14 - MSDS Transport Information
Section 7 - Handling and Storage	Section 15 - Regulatory Information
Section 8 - Exposure Controls & Personal Protection	Section 16 - Other Information

The information in this document is compiled from information maintained by the United States Department of Defense (DOD). Anyone using this information is solely reponsible for the accuracy and applicability of this information to a particular use or situation.

Cornell University does not in any way warrant or imply the applicability, viability or use of this information to any person or for use in any situation.

Section 1 - Product and Company Identification METHYL TERTIARY BUTYL ETHER

Product Identification: METHYL TERTIARY BUTYL ETHER Date of MSDS: 11/01/1990 Technical Review Date: 12/21/1995 FSC: 6810 NIIN: LIIN: 00N066437 Submitter: N EN Status Code: C MIFN: 01 Article: N Kit Part: N

Manufacturer's Information

Manufacturer's Name: GENIUM PUBLISHING CORP Manufacturer's Address1: 1145 CATALYN ST Manufacturer's Address2: SCHENECTADY, NY 12303-1836 Manufacturer's Country: US General Information Telephone: 518-377-8854 Emergency Telephone: 518-377-8854 Emergency Telephone: 518-377-8854 MSDS Preparer's Name: MJ ALLISON Proprietary: N Reviewed: N Published: Y CAGE: 5Z768 Special Project Code: N

Contractor Information

Contractor's Name: GENIUM PUBLISHING CORPORATION Contractor's Address1: 1145 CATALYN ST Contractor's Address2: SCHENECTADY, NY 12303-1836 Contractor's Telephone: 518-377-8854 Contractor's CAGE: 5Z768

Section 2 - Compositon/Information on Ingredients METHYL TERTIARY BUTYL ETHER

Ingredient Name: EFTS OF OVEREXP:NOSE, THROAT, SKIN & CORNEA. ASPIR OF GASOLINE-MTBE MIX MAY CAUSE LUNG PNEUM. ACUTE:CONT W/EYES (ING 4) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ETHER, TERT-BUTYL METHYL; (METHYL TERT-BUTYL ETHER) (SARA 313) (CERCLA) Ingredient CAS Number: 1634-04-4 Ingredient CAS Code: M RTECS Number: KN5250000 RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: 100 % Enviromental Weight: **Other REC Limits: N/K** OSHA PEL: N/K (FP N) OSHA PEL Code: M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: N/K (FP N) ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity:** 1 LB **DOT Reporting Quantity:** 1 LB **Ozone Depleting Chemical:** N

Ingredient Name: FIRST AID:MOUTH IF UNCON/CONVL. IF INGEST, CONSULT MD IMMED. DO NOT INDUCE VOMIT DUE TO ASPIR PNEUM RISK. IF (ING 7) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Environmental Weight: **Other REC Limits:** N/K **OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: HYGIENE PRACT: DRINKING, SMKG, USING TOILET/APPLYING COSMETICS. CONTAMD EQUIP:NEVER WEAR CONT LENSES IN WORK (ING 23) **Ingredient CAS Number: Ingredient CAS Code: X** RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 10:SUBSTANTIAL MTBE EXPOS. PFT'S, CHEST X-RAYS & SUPPORTIVE CARE MAY BE NEC AFTER ASPIR EXPOSURES. Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code: ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 12:(EXPLO)/WATERWAYS. MTBE IS MORE WATER SOL/OTHER

GASOLINE COMPONENTS, SO THERE MAY BE HIGHER MBTE CONC IN (ING 14) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Ouantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 13: GROUNDWATER WHEN THERE IS SPILL OF GASOLINE-MTBE MIX. IT ALSO HAS MOD TO HIGH MOBILITY IN SOIL. MTBE IS (ING 15) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code:

% Text: N/K

% Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 14: POORLY BIODEGRADED BY MICROORGANISMS IN ACTIVATED SLUDGE. CLEANUP OF GROUNDWATER CONTAM IS DFCLT. WHEN (ING 16)

Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 15:HIGH AIR-TO-WATER RATIOS ARE USED, AIR STRIPPING SYS CAN REMOVE MTBE. PROD OF ATM DEGRADATION INCL (ING 17) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M

OSHA STEL: OSHA STEL Code:

ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M ACGIH STEL: N/P ACGIH STEL Code:

EPA Reporting Quantity:

DOT Reporting Quantity:

Ozone Depleting Chemical:

Ingredient Name: ING 16:T-BUTYL FORMATE, ACETONE, & METHYL RADICALS. FOLLOW APPLIC OSHA REGS (29 CFR 1910.120). **Ingredient CAS Number: Ingredient CAS Code:** X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 18:PRACTICE GOOD PERSONAL HYGIENE & HOUSEKEEPING PROCEDURES. **Ingredient CAS Number: Ingredient CAS Code: X** RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 22:AREA; SOFT LENSES MAY ABSORB, & ALL LENSES CONC, IRRITANTS. REMOVE THIS MATL FROM YOUR SHOES & EQUIP. (ING 24) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 23:LAUNDER CONTAM CLOTHING BEFORE WEARING. **Ingredient CAS Number: Ingredient CAS Code: X** RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 3:OR SKIN MAY CAUSE IRRIT/BURNING @ HIGH CONC. INHAL MAY RSLT IN NAUS, VOMIT, SEDATION & GEN ATHESIA (CNS & (ING 5) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: ING 4:RESP DEPRESS). INGEST OF MTBE MAY RSLT IN ASPIR PNEUM. CHRONIC: CHRONIC INHAL CAUSES NASAL & TRACHEAL INFLAMM. Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 99999992Z RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 6:PERS IS COUGH/CHOCKING, ASPIR MAY HAVE ALREADY OCCURRED; TRANSPORT TO EMER MED FACILITY. AFTER FIRST AID, (ING 8) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 7: INGEST BECAUSE OF IT'S POOR ABSORBING OUALITIES. CAREFULLY OBSERVE FOR ANY DEVELOPMENT OF SYSTEMIC SIGNS. (ING 9) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code: =Volume: =Volume Code:** >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 8:IF LG QTYS OF MTBE INGESTED, SYRUP OF IPECAC IS PREF TO LAVAGE IN ALERT PATIENT REQ EMESIS. IF ASPIR HAS (ING 10) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 99999992Z RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code: ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:**

Ingredient Name: ING 9: OCCURRED, OBTAIN BASELINE CHEST X-RAY & VITAL SIGNS. LIVER FUNC STUDIES MAY BE INDICATED FOLLOWING (ING 11) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: OTHER PREC: PROT PROGRAM THAT INCL REGULAR TRAINING, MAINTENANCE, INSPECTION, & EVAL. AVOID HEAT & IGNIT SOURCES.(ING 19) Ingredient CAS Number: Ingredient CAS Code: X

MAINTENANCE, INSPECTION, & EVAL. AVOID HEAT & IGNIT SOURCES.(ING 19) Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code:
% Low WT: % Low WT Code:
% High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Ingredient Name: RESP PROT:SCBA. WARNING! NIOSH/MSHA APPRVD AIR-PURIFYING RESPS DO NOT PROTECT WORKERS IN OXYG-DEFICIENT ATM. **Ingredient CAS Number: Ingredient CAS Code: X** RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M **OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: SPILL PROC:FOR DISP. FOR LG SPILLS, DIKE FAR AHEAD OF SPILL TO CNTN. DO NOT ALLOW MTBE TO ENTER ENCLOSED AREAS(ING 13) **Ingredient CAS Number: Ingredient CAS Code: X** RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code:

>WT: >WT Code:
>Volume: >Volume Code:
<WT: <WT Code:
<Volume: <Volume Code:</pre>

% Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Environmental Weight: **Other REC Limits: N/K OSHA PEL: NOT APPLICABLE OSHA PEL Code: M OSHA STEL: OSHA STEL Code:** ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M **ACGIH STEL: N/P ACGIH STEL Code: EPA Reporting Quantity: DOT Reporting Quantity: Ozone Depleting Chemical:** Ingredient Name: SUPDAT: RADICALS. IF PRESENT IS SUFFICIENT CONC, THESE PROD OF PARTIAL OXIDATION CAN POSE SERIOUS HLTH HAZARD. Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 9999999ZZ RTECS Code: M **=WT: =WT Code:** =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code: % Low Volume: % Low Volume Code: % High Volume: % High Volume Code: % Text: N/K % Enviromental Weight: **Other REC Limits:** N/K **OSHA PEL:** NOT APPLICABLE **OSHA PEL Code:** M

- OSHA STEL: OSHA STEL Code:
- ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
- ACGIH STEL: N/P ACGIH STEL Code:
- **EPA Reporting Quantity:**
- **DOT Reporting Quantity:**
- **Ozone Depleting Chemical:**

Ingredient Name: VENT:PRODUCTIVITY LOC EXHST VENT IS PREF SINCE IT PVNT CONTAM DISPERSION INTO WORK AREA BY CONTROLLING IT @ ITS SOURCE. Ingredient CAS Number: Ingredient CAS Code: X RTECS Number: 99999992Z RTECS Code: M =WT: =WT Code: =Volume: =Volume Code: >WT: >WT Code: >Volume: >Volume Code: <WT: <WT Code: <Volume: <Volume Code: % Low WT: % Low WT Code: % High WT: % High WT Code:
% Low Volume: % Low Volume Code:
% High Volume: % High Volume Code:
% Text: N/K
% Enviromental Weight:
Other REC Limits: N/K
OSHA PEL: NOT APPLICABLE OSHA PEL Code: M
OSHA STEL: OSHA STEL Code:
ACGIH TLV: NOT APPLICABLE ACGIH TLV Code: M
ACGIH STEL: N/P ACGIH STEL Code:
EPA Reporting Quantity:
DOT Reporting Quantity:
Ozone Depleting Chemical:

Section 3 - Hazards Identification, Including Emergency Overview METHYL TERTIARY BUTYL ETHER

Health Hazards Acute & Chronic: TARGET ORGANS:UPPER RESP TRACT, CNS. MTBE INGEST & INHAL TOX ARE BASED ON ANIMAL STUDIES. HUMAN EXPOS ARE REPORTED PRIMARILY W/EXPOS TO GASOLINE-MTBE MIX & W/USE OF MTBE IN DISSOLVING GALL BLADDER STO NES BY DIRECT INFUSION. RPTS REVEAL MTBE'S PRIMARY ANESTH EFT ON CNS. PROGRESSION OF NAUS, VOMIT & (EFTS OF OVEREXP)

Signs & Symptoms of Overexposure:

HLTH HAZ:SEDATION FOLLOWED BY GEN ANESTH IS NOTED W/INCRG EXPOS. WARM/BURNING SENSATION IS REPORTED W/GALL BLADDER INSTILLATION. ELEVATED LIVER FUNC STUDIES, DUODENAL INFLAMM, KIDNEY FAILURE, BLOOD CE LL HEMOLYSIS, & FOUL BREATH ODOR ARE ALSO NOTED W/THIS PROC. ANIMAL STUDIES NOTE PRIMARY IRRIT TO MUC MEMB (ING 3)

Medical Conditions Aggravated by Exposure:

NONE REPORTED.

LD50 LC50 Mixture: LD50:(ORAL,RAT) 4 G/KG

Route of Entry Indicators: Inhalation: YES

Skin: YES Ingestion: YES

Carcenogenicity Indicators NTP: NO

IARC: NO OSHA: NO

Carcinogenicity Explanation: NOT RELEVANT.

Section 4 - First Aid Measures METHYL TERTIARY BUTYL ETHER

http://msds.ehs.cornell.edu/msds/msdsdod/a435/m217471.htm

First Aid:

EYES:GENTLY LIFT LIDS & FLUSH IMMED & CONTINUOUSLY W/FLOODING AMTS OF WATER FOR @ LEAST 15 MIN UNTIL TRANSPORTED TO EMER MED FACILITY. CONSULT MD IMMED. SKIN:QUICKLY REMOVE CONTAMD CLTHG. RINSE W/FLOO DING AMTS OF WATER FOR @ LEAST 15 MIN. FOR RED/BLISTERED SKIN, CONSULT MD. WASH AFFECTED AREA W/SOAP & WATER. INHAL:REMOVE TO FRESH AIR & SUPPORT BRTHG AS NEEDED. INGEST:NEVER GIVE ANYTHING BY (ING 6)

Section 5 - Fire Fighting Measures METHYL TERTIARY BUTYL ETHER

Fire Fighting Procedures:

NIOSH/MSHA APPRVD SCBA & FULL PROT EQUIP(FP N) (INCLG GOGG, RUB OVER-CLTHG, GLOVES & BOOTS). IF FEASIBLE, REMOVE CNTNRS FROM FIRE-RISK AREA. OTHERWISE (SUPDAT)

Unusual Fire or Explosion Hazard:

MTBE IS EXTREMELY FLAM. VAP MAY EXPLODE IF IGNIT IN ENCLSD AREA/TRAVEL TO SOURCE OF IGNIT & FLASH BACK. @ TEMP AT/ABOVE FL PT, MTBE CAN RELS VAPS THAT (SUPDAT)

Extinguishing Media:

USE DRY CHEMICAL, CARBON DIOXIDE, HALON, WATER SPRAY, OR ALCOHOL FOAM AS EXTINGUISHING MEDIA.

Flash Point: Flash Point Text: <18F,<-8C

Autoignition Temperature: Autoignition Temperature Text: N/A Lower Limit(s): 1.6% Upper Limit(s): 8.4%

Section 6 - Accidental Release Measures METHYL TERTIARY BUTYL ETHER

Spill Release Procedures: NOTIFY SFTY PERS, EVAC ALL UNNEC PERS, REMOVE ALL HEAT & IGNIT SOURCES, & PROVIDE MAX EXPLO-PROOF VENT. CLEANUP PERS SHOULD PROTECT AGAINST VAP INHAL & SKIN/EYE CONT. TAKE UP SPILLED MATL W/NONCOMBUST ABSORB MATL & PLACE IN APPROP CNTNRS (ING 12)

Section 7 - Handling and Storage METHYL TERTIARY BUTYL ETHER

Handling and Storage Precautions:

Other Precautions:

Section 8 - Exposure Controls & Personal Protection METHYL TERTIARY BUTYL ETHER

Repiratory Protection: SEEK PROFESSIONAL ADVICE PRIOR TO RESP SELECTION & USE. FOLLOW OSHA RESP REGS (29 CFR 1910.134) &, IF NEC, WEAR NIOSH/MSHA APPRVD RESP. FOR EMER/NONROUTINE OPERATIONS (CLEANING SPILLS, REACTOR VESSELS /STOR TANKS), WEAR NIOSH/MSHA (ING 20) Ventilation: PROVIDE GEN & LOC EXPLO-PROOF VENT SYS TO MAINTAIN AIRBORNE CONC @ LEV THAT PROMOTE WORKER SFTY & (ING 21) **Protective Gloves:** IMPERVIOUS GLOVES. Eve Protection: ANSI APPRVD CHEM WORKERS GOGG & FSHLD. **Other Protective Equipment:** IMPERVIOUS BOOTS, APRONS, & GAUNTLETS. ANSI APPRVD EMER EYE WASH & DELUGE SHOWER (FP N). Work Hygenic Practices: NEVER EAT, DRINK/SMOKE IN WORK AREAS. PRACTICE GOOD PERSONAL HYGIENE AFTER USING MATL, EXPECIALLY BEFORE EATING, (ING 22) Supplemental Health & Safety Information: APPEAR/ODOR:MINT OR TERPENE-LIKE ODOR. FIRE FIGHT PROC: USE WATER SPRAY TO COOL FIRE-EXPOS CNTNRS. BE AWARE OF RUNOFF FROM FIRE CTL METH. DO NOT RELS TO ENCLSD AREAS, SEWERS/WATERWAYS DUE TO POTNTL EXP LO & HLTH HAZ MTBE PRESENT. EXPLO HAZ: FORM FLAM MIXS. CNDTNS TO AVOID: IN ACID SOLNS. HAZ DECOMP:& METHYL (ING 2)

Section 9 - Physical & Chemical Properties METHYL TERTIARY BUTYL ETHER

HCC:

NRC/State License Number: Net Property Weight for Ammo: Boiling Point: Boiling Point Text: 131F,55C Melting/Freezing Point: Melting/Freezing Text: <166F,<74C **Decomposition Point: Decomposition Text: N/K** Vapor Pressure: 245 @ 77F Vapor Density: N/K **Percent Volatile Organic Content:** Specific Gravity: 0.7405(20C/4C) **Volatile Organic Content Pounds per Gallon:** pH: N/K **Volatile Organic Content Grams per Liter:** Viscosity: N/P **Evaporation Weight and Reference: NOT KNOWN** Solubility in Water: 4.8G/100G Appearance and Odor: A CLEAR, COLORLESS LIQUID WITH A SLIGHT HYDROCARBON ODOR WITH A MILD (SUPDAT) Percent Volatiles by Volume: N/K **Corrosion Rate:** N/K

Section 10 - Stability & Reactivity Data METHYL TERTIARY BUTYL ETHER

Stability Indicator: YES Materials to Avoid: INCOMPAT & UNSTABLE W/STRONG OXIDIZING AGENTS, STRONG ACIDS, CAUSTICS, AMINES, ALDEHYDES, AMMONIA, & CHLORINATED CMPDS. Stability Condition to Avoid:

HEAT & IGNIT SOURCES. MTBE IS STABLE @ ROOM TEMP IN CLSD CNTNRS UNDER NORM STOR & HNDLG CNDTNS. MTBE IS UNSTABLE(SUPDAT) Hazardous Decomposition Products: THERM OXIDATIVE DECOMP CAN PRDCE: CO*2 & H*20 VAP; INCOMPLETE COMBUST:CO, T-BUTYL FORMATE, ACETONE, FORMIC ACID (SUPDAT) Hazardous Polymerization Indicator: NO Conditions to Avoid Polymerization: NOT RELEVANT.

Section 11 - Toxicological Information METHYL TERTIARY BUTYL ETHER

Toxicological Information: N/P

Section 12 - Ecological Information METHYL TERTIARY BUTYL ETHER

Ecological Information: N/P

Section 13 - Disposal Considerations METHYL TERTIARY BUTYL ETHER

Waste Disposal Methods: CONTACT YOUR SUPPLIER/LICENSED CONTRACTOR FOR DETAILED RECOMMENDATIONS. FOLLOW APPLIC FEDERAL, STATE, AND LOCAL REGS.

Section 14 - MSDS Transport Information METHYL TERTIARY BUTYL ETHER

Transport Information: N/P

Section 15 - Regulatory Information METHYL TERTIARY BUTYL ETHER

SARA Title III Information: N/P Federal Regulatory Information: N/P State Regulatory Information: N/P

Section 16 - Other Information METHYL TERTIARY BUTYL ETHER

Other Information: N/P

HAZCOM Label Information

Product Identification: METHYL TERTIARY BUTYL ETHER **CAGE:** 5Z768

Assigned Individual: N **Company Name: GENIUM PUBLISHING CORPORATION Company PO Box:** Company Street Address1: 1145 CATALYN ST Company Street Address2: SCHENECTADY, NY 12303-1836 US Health Emergency Telephone: 518-377-8854 Label Required Indicator: Y Date Label Reviewed: 12/21/1995 Status Code: C **Manufacturer's Label Number:** Date of Label: 12/21/1995 Year Procured: N/K **Organization Code:** G **Chronic Hazard Indicator:** Y **Eve Protection Indicator: YES** Skin Protection Indicator: YES **Respiratory Protection Indicator: YES** Signal Word: DANGER Health Hazard: Severe **Contact Hazard:** Severe Fire Hazard: Severe Reactivity Hazard: Slight

8/9/2002 9:24:08 AM

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



date of compilation: 2016-06-29 Revision: 2019-03-08

m-Xylene \geq 99%, for synthesis

article number: **3791** Version: **2.0 en** Replaces version of: 2016-07-04 Version: (1)

SECTION 1: Identification of the substance/mixture and of the company/ undertaking

1.1	Product identifier	
	Identification of the substance	m-Xylene
	Article number	3791
	Registration number (REACH)	It is not required to list the identified uses be- cause the substance is not subject to registration according to REACH (< 1 t/a)
	Index No	601-022-00-9
	EC number	203-576-3
	CAS number	108-38-3
1.2	Relevant identified uses of the substance or mix	ture and uses advised against
	Identified uses:	laboratory chemical laboratory and analytical use
1.3	Details of the supplier of the safety data sheet	
	Carl Roth GmbH + Co KG Schoemperlenstr. 3-5 D-76185 Karlsruhe Germany	
	Telephone: +49 (0) 721 - 56 06 0 Telefax: +49 (0) 721 - 56 06 149 e-mail: sicherheit@carlroth.de Website: www.carlroth.de	
	Competent person responsible for the safety data sheet	: Department Health, Safety and Environment
	e-mail (competent person)	: sicherheit@carlroth.de
1.4	Emergency telephone number	
	Emergency information service	Poison Centre Munich: +49/(0)89 19240
SEC	TION 2: Hazards identification	
2.1	Classification of the substance or mixture	
	Classification according to Regulation (EC) No 12	272/2008 (CLP)

Classification acc. to GHS			
Section	Hazard class	Hazard class and cat- egory	Hazard state- ment
2.6	flammable liquid	(Flam. Liq. 3)	H226
3.1D	acute toxicity (dermal)	(Acute Tox. 4)	H312
3.1I	acute toxicity (inhal.)	(Acute Tox. 4)	H332
3.2	skin corrosion/irritation	(Skin Irrit. 2)	H315

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Classification acc. to GHS			
Section	Hazard class	Hazard class and cat- egory	Hazard state- ment
3.3	serious eye damage/eye irritation	(Eye Irrit. 2)	H319
3.8R	specific target organ toxicity - single exposure (respiratory tract ir- ritation)	(STOT SE 3)	H335
3.9	specific target organ toxicity - repeated exposure	(STOT RE 2)	H373
3.10	aspiration hazard	(Asp. Tox. 1)	H304

2.2 Label elements

Labelling according to Regulation (EC) No 1272/2008 (CLP)

Signal word Da	nger
----------------	------

Pictograms



Hazard statements

H226	Flammable liquid and vapour
H304	May be fatal if swallowed and enters airways
H312+H332	Harmful in contact with skin or if inhaled
H315	Causes skin irritation
H319	Causes serious eye irritation
H335	May cause respiratory irritation
H373	May cause damage to organs (respiratory system, nervous system) through pro-
H373	longed or repeated exposure

Precautionary statements

Precautionary statements - prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition
	sources. No smoking.
P260	Do not breathe mist/vapours/spray.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statements - response

P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor/
P302+P352	IF ON SKIN: Wash with plenty of soap and water.
P305+P351+P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact
	lenses, if present and easy to do. Continue rinsing.
P331	Do NOT induce vomiting.

Labelling of packages where the contents do not exceed 125 ml

Signal word: Danger



according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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H304	May be fatal if swallowed and enters airways.
P301+P310	IF SWALLOWED: Immediately call a POISON CENTER/doctor.
P331	Do NOT induce vomiting.

2.3 Other hazards

There is no additional information.

SECTION 3: Composition/information on ingredients

3.1 Substances

Name of substance	1,3-Dimethylbenzene
Index No	601-022-00-9
EC number	203-576-3
CAS number	108-38-3
Molecular formula	C ₈ H ₁₀
Molar mass	106,2 ^g / _{mol}

SECTION 4: First aid measures

4.1 Description of first aid measures



General notes

Take off contaminated clothing.

Following inhalation

Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact

Rinse skin with water/shower. In case of skin irritation, consult a physician.

Following eye contact

Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart. In case of eye irritation consult an ophthalmologist.

Following ingestion

Rinse mouth. Do not induce vomiting. Aspiration hazard. Call a physician immediately.

4.2 Most important symptoms and effects, both acute and delayed

Irritation, Cough, Headache, Impairment of vision, Dizziness, Vertigo, Nausea, Vomiting, Diarrhoea, Breathing difficulties, Unconsciousness, Aspiration hazard

4.3 Indication of any immediate medical attention and special treatment needed

none

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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SECTION 5: Firefighting measures

5.1 Extinguishing media



Suitable extinguishing media

Co-ordinate fire-fighting measures to the fire surroundings water spray, foam, dry extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing media

water jet

5.2 Special hazards arising from the substance or mixture

Combustible. Vapours are heavier than air, spread along floors and form explosive mixtures with air.

Hazardous combustion products

In case of fire may be liberated: carbon monoxide (CO), carbon dioxide (CO2)

5.3 Advice for firefighters

Vapours are heavier than air. Beware of reignition. Fight fire with normal precautions from a reasonable distance. Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures



For non-emergency personnel

Use personal protective equipment as required. Avoid contact with skin, eyes and clothes. Do not breathe vapour/spray. Avoidance of ignition sources.

6.2 Environmental precautions

Keep away from drains, surface and ground water. Explosive properties.

6.3 Methods and material for containment and cleaning up

Advices on how to contain a spill

Covering of drains.

Advices on how to clean up a spill

Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases

Place in appropriate containers for disposal. Ventilate affected area.

6.4 Reference to other sections

Hazardous combustion products: see section 5. Personal protective equipment: see section 8. Incompatible materials: see section 10. Disposal considerations: see section 13.
according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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SECTION 7: Handling and storage

7.1 Precautions for safe handling

Provide adequate ventilation as well as local exhaustion at critical locations. Avoid exposure. When not in use, keep containers tightly closed.

• Measures to prevent fire as well as aerosol and dust generation

Keep away from sources of ignition - No smoking.

Take precautionary measures against static discharge.

Advice on general occupational hygiene

Wash hands before breaks and after work. Keep away from food, drink and animal feedingstuffs. When using do not smoke.

7.2 Conditions for safe storage, including any incompatibilities

Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight.

Incompatible substances or mixtures

Observe hints for combined storage.

Consideration of other advice

Ground/bond container and receiving equipment.

Ventilation requirements

Use local and general ventilation.

Specific designs for storage rooms or vessels

Recommended storage temperature: 15 – 25 °C.

7.3 Specific end use(s)

No information available.

SECTION 8: Exposure controls/personal protection

8.1 **Control parameters**

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

Coun- try	Name of agent	CAS No	Identifier	TWA [ppm]	TWA [mg/ m³]	STEL [ppm]	STEL [mg/ m³]	Source
EU	m-xylene	108-38-3	IOELV	50	221	100	442	2000/39/EC
GB	m-xylene	108-38-3	WEL	50	220	100	441	EH40/2005

Notation STEL

TWA

Short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15minute period (unless otherwise specified) Time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8

hours time-weighted average (unless otherwise specified)

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Biological limit values

Coun- try	Name of agent	Parameter	Identifier	Value	Material	Source
GB	m-xylene	methylhippuric acids	BMGV	650 mmol/ mol	urine	EH40/2005

Relevant DNELs/DMELs/PNECs and other threshold levels

• human health values

Endpoint	Threshold level	Protection goal, route of exposure	Used in	Exposure time
DNEL	221 mg/m³	human, inhalatory	worker (industry)	chronic - systemic effects
DNEL	442 mg/m ³	human, inhalatory	worker (industry)	acute - systemic effects
DNEL	221 mg/m³	human, inhalatory	worker (industry)	chronic - local effects
DNEL	442 mg/m ³	human, inhalatory	worker (industry)	acute - local effects
DNEL	212 mg/kg bw/ day	human, dermal	worker (industry)	chronic - systemic effects

environmental values

Endpoint	Threshold level	Environmental compartment	
PNEC	0,25 ^{mg} / _l	water	
PNEC	0,044 ^{mg} / _l	freshwater	
PNEC	0,004 ^{mg} / _l	marine water	
PNEC	1,6 ^{mg} / _l	sewage treatment plant (STP)	
PNEC	2,52 ^{mg} / _{kg}	freshwater sediment	
PNEC	0,252 ^{mg} / _{kg}	marine sediment	
PNEC	0,852 ^{mg} / _{kg}	soil	

8.2 Exposure controls

Individual protection measures (personal protective equipment)

Eye/face protection



Use safety goggle with side protection.

Skin protection



hand protection

Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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- type of material
- FKM (fluoro rubber)
- material thickness

0,4 mm.

• breakthrough times of the glove material

>480 minutes (permeation: level 6)

other protection measures

Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

Respiratory protection



Respiratory protection necessary at: Aerosol or mist formation. Type: A (against organic gases and vapours with a boiling point of > 65 $^{\circ}$ C, colour code: Brown).

Environmental exposure controls

Keep away from drains, surface and ground water.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical state	liquid (fluid)
Colour	colourless
Odour	characteristic
Odour threshold	No data available
Other physical and chemical parameters	
pH (value)	This information is not available.
Melting point/freezing point	-47,8 °C at 1.013 hPa
Initial boiling point and boiling range	139,1 °C at 1.013 hPa
Flash point	27 °C at 1.013 hPa
Evaporation rate	no data available
Flammability (solid, gas)	not relevant (fluid)
Explosive limits	
lower explosion limit (LEL)	1,1 vol%
• upper explosion limit (UEL)	7 vol%
Explosion limits of dust clouds	not relevant
Vapour pressure	8 hPa at 20 °C
Density	0,86 ^g / _{cm³} at 25 °C
Vapour density	3,66 (air = 1)

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Bulk density	Not applicable
Relative density	Information on this property is not available.
Solubility(ies)	
Water solubility	~ 146 ^{mg} / _l at 25 °C
Partition coefficient	
n-octanol/water (log KOW)	3,2 (pH value: 7, 20 °C) (ECHA)
Soil organic carbon/water (log KOC)	2,73 (ECHA)
Auto-ignition temperature	528 °C at 1.013 hPa - ECHA
Decomposition temperature	no data available
Viscosity	
• kinematic viscosity	0,6756 ^{mm²} / _s
• dynamic viscosity	0,581 mPa s at 25 °C
Explosive properties	Shall not be classified as explosive
Oxidising properties	none
Other information	
Surface tension	28,01 ^{mN} / _m (25 °C)
Temperature class (EU, acc. to ATEX)	T1 (Maximum permissible surface temperature

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

Risk of ignition. In case of warming: Vapours can form explosive mixtures with air.

10.2 Chemical stability

The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions

Violent reaction with: Oxidisers, Nitric acid, Sulphuric acid, Sulphur, Acids

10.4 Conditions to avoid

Keep away from heat.

10.5 Incompatible materials

plastic and rubber

10.6 Hazardous decomposition products

Hazardous combustion products: see section 5.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Exposure route	Endpoint	Value	Species	Source
oral	LD50	3.523 ^{mg} / _{kg}	rat	ECHA

Skin corrosion/irritation

Causes skin irritation.

Serious eye damage/eye irritation

Causes serious eye irritation.

Respiratory or skin sensitisation

Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties

Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant

• Specific target organ toxicity - single exposure

May cause respiratory irritation.

• Specific target organ toxicity - repeated exposure

May cause damage to organs (respiratory system, nervous system) through prolonged or repeated exposure.

Aspiration hazard

May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

• If swallowed

diarrhoea, vomiting, aspiration hazard

• If in eyes

Causes serious eye irritation

• If inhaled

irritant effects, cough, breathing difficulties, pulmonary oedema

• If on skin

causes skin irritation, risk of absorption via the skin

Other information

Other adverse effects: Headache, Impairment of vision, Dizziness, Vertigo, Nausea, Dyspnoea, Unconsciousness, Liver and kidney damage, Symptoms can occur only after several hours

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



m-Xylene \geq 99%, for synthesis

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SECTION 12: Ecological information

12.1 Toxicity

acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.

Aquatic toxicity (acute)

Endpoint	Value	Species	Source	Exposure time
LC50	2,6 ^{mg} / _l	rainbow trout	ECHA	96 h
ErC50	4,7 ^{mg} / _l	algae	ECHA	72 h

Aquatic toxicity (chronic)

Endpoint	Value	Species	Source	Exposure time
EC50	2,2 ^{mg} / _l	algae	ECHA	73 h
NOEC	0,714 ^{mg} / _l	striped brill	ECHA	35 d
NOEC	1,57 ^{mg} / _l	aquatic invertebrates	ECHA	21 d
NOEC	0,44 ^{mg} / _l	algae	ECHA	73 h

12.2 Process of degradability

The substance is readily biodegradable. Theoretical Oxygen Demand: 3,165 ^{mg}/_{mg} Theoretical Carbon Dioxide: 3,316 ^{mg}/_{mg}

Process	Degradation rate	Time
oxygen depletion	90 %	28 d

12.3 Bioaccumulative potential

Does not significantly accumulate in organisms.

	n-octanol/water (log KOW)	3,2 (pH value: 7, 20 °C)
	BCF	>5,5 - <12,2
12.4	Mobility in soil	
	Henry's law constant	623 ^{Pa m³} / _{mol} at 25 °C
	The Organic Carbon normalised adsorption coefficient	2,73
12.5	Results of PBT and vPvB assessment	
	Data are not available.	
12.6	Other adverse effects	
	Data are not available.	

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



m-Xylene \geq 99%, for synthesis

article number: **3791**

SECTION 13: Disposal considerations

13.1 Waste treatment methods



This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations.

Sewage disposal-relevant information

Do not empty into drains.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

Sewage disposal-relevant information

Do not empty into drains.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste

The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks

Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.

1307

XYLENES

m-Xylene

SECTION 14: Transport information

- 14.1 UN number
- **14.2** UN proper shipping name Hazardous ingredients
- 14.3 Transport hazard class(es)

Class

- **14.4** Packing group
- **14.5** Environmental hazards

3 (flammable liquids) III (substance presenting low danger)

NONE (non-environmentally hazardous acc. to the dangerous goods regulations)

14.6 Special precautions for user

Provisions for dangerous goods (ADR) should be complied within the premises.

14.7 Transport in bulk according to Annex II of MARPOL and the IBC Code

The cargo is not intended to be carried in bulk.

14.8 Information for each of the UN Model Regulations

• Transport of dangerous goods by road, rail and inland waterway (ADR/RID/ADN)

UN number

1307

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



m-Xylene \geq 99%, for synthesis

article	number:	3791
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Proper shipping name	XYLENES
Particulars in the transport document	UN1307, XYLENES, 3, III, (D/E)
Class	3
Classification code	F1
Packing group	III
Danger label(s)	3
Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
Transport category (TC)	3
Tunnel restriction code (TRC)	D/E
Hazard identification No	30
Emergency Action Code	3YE
• International Maritime Dangerous Goods	s Code (IMDG)
UN number	1307
Proper shipping name	XYLENES
Particulars in the shipper's declaration	UN1307, XYLENES, 3, III, 27°C c.c.
Class	3
Marine pollutant	-
Packing group	III
Danger label(s)	3
Special provisions (SP)	223
Excepted quantities (EQ)	E1
Limited quantities (LQ)	5 L
EmS	F-E, S-D
Stowage category	A
• International Civil Aviation Organization	(ICAO-IATA/DGR)
UN number	1307
Proper shipping name	Xylenes
Particulars in the shipper's declaration	UN1307, Xylenes, 3, III
Class	3
Packing group	III

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Danger label(s)	3
•	
Special provisions (SP)	A3
Excepted quantities (EQ)	E1
Limited quantities (LQ)	10 L

SECTION 15: Regulatory information

Safety, health and environmental regulations/legislation specific for the substance or mixture 15.1 Relevant provisions of the European Union (EU)

• Regulation 649/2012/EU concerning the export and import of hazardous chemicals (PIC) Not listed.

• Regulation 1005/2009/EC on substances that deplete the ozone layer (ODS)

Not listed.

• Regulation 850/2004/EC on persistent organic pollutants (POP)

Not listed.

• Restrictions according to REACH, Annex XVII

Name of substance	CAS No	Wt%	Type of registration	Conditions of restric- tion	Νο
m-Xylene		100	1907/2006/EC annex XVII	R3	3
m-Xylene		100	1907/2006/EC annex XVII	R40	40

Legend

R3

- ornamental articles intended to produce light or colour effects by means of different phases, for example in ornamental lamps and ashtrays,

- tricks and jokes,

- games for one or more participants, or any article intended to be used as such, even with ornamental aspects,

Articles not complying with paragraph 1 shall not be placed on the market.
 Shall not be placed on the market if they contain a colouring agent, unless required for fiscal reasons, or perfume, or both, if they:

- can be used as fuel in decorative oil lamps for supply to the general public, and,
- present an aspiration hazard and are labelled with R65 or H304,
4. Decorative oil lamps for supply to the general public shall not be placed on the market unless they conform to the European Standard on Decorative oil lamps (EN 14059) adopted by the European Committee for Standardisation (CEN).

5. Without prejudice to the implementation of other Community provisions relating to the classification, pack-aging and labelling of dangerous substances and mixtures, suppliers shall ensure, before the placing on the market, that the following requirements are met:
(a) lamp oils, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked as follows: 'Keep lamps filled with this liquid out of the reach of children'; and, by 1 December 2010, 'Just a vision's descent of the vision's de

sip of lamp oil - or even sucking the wick of lamps - may lead to life-threatening lung damage'; (b) grill lighter fluids, labelled with R65 or H304, intended for supply to the general public are legibly and indelibly marked by 1 December 2010 as follows: 'Just a sip of grill lighter may lead to life threatening lung damage'; (c) lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are packaged in black opaque containers not exceeding 1 litre by 1 December 2010. 6. No later than 1 June 2014, the Commission shall request the European Chemicals Agency to prepare a dossier, in accordance with Article 60 of the preparet Population with a view to bar if appropriate grill lighter fluids and

in accordance with Article 69 of the present Regulation with a view to ban, if appropriate, grill lighter fluids and fuel for decorative lamps, labelled R65 or H304, intended for supply to the general public.
Natural or legal persons placing on the market for the first time lamp oils and grill lighter fluids, labelled with R65 or H304, shall by 1 December 2011, and annually thereafter, provide data on alternatives to lamp oils and grill lighter fluids and grill lighter fluids labelled R65 or H304 to the competent authority in the Member State concerned. Member States to the Commercial of the to the competent authority in the Member State concerned. shall make those data available to the Commission.

^{1.} Shall not be used in:

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Legend

R40

1. Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are inten-ded for supply to the general public for entertainment and decorative purposes such as the following: - metallic glitter intended mainly for decoration,

- artificial snow and frost,
- 'whoopee' cushions,
- silly string aerosols, - imitation excrement,
- horns for parties,
 decorative flakes and foams,
- artificial cobwebs,
- stink bombs.

Without prejudice to the application of other Community provisions on the classification, packaging and labeling of substances, suppliers shall ensure before the placing on the market that the packaging of aerosol dispensers referred to above is marked visibly, legibly and indelibly with:
 'For professional users only'.

3. By way of derogation, paragraphs 1 and 2 shall not apply to the aerosol dispensers referred to Article 8 (1a) of Council Directive 75/324/EEC (2).

4. The aerosol dispensers referred to in paragraphs 1 and 2 shall not be placed on the market unless they conform to the requirements indicated.

• Restrictions according to REACH, Title VIII

None.

List of substances subject to authorisation (REACH, Annex XIV)/SVHC - candidate list not listed

Seveso Directive

2012/18/EU (Seveso III)				
No	Dangerous substance/hazard categories	Qualifying quantity plication of lower quirer	(tonnes) for the ap- and upper-tier re- nents	Notes
P5c	flammable liquids (cat. 2, 3)	5.000	50.000	51)

Notation

Flammable liquids, categories 2 or 3 not covered by P5a and P5b 51)

Directive 75/324/EEC relating to aerosol dispensers

Filling batch

Deco-Paint Directive (2004/42/EC)

VOC content	100 % 860 ^g /l	
Directive on industrial emissions (VOCs, 2010/75/EU)		
VOC content	100 %	
VOC content	860 ^g / _l	

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) - Annex II

not listed

Regulation 166/2006/EC concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)

not listed

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD)

not listed

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Regulation 98/2013/EU on the marketing and use of explosives precursors not listed

Regulation 111/2005/EC laying down rules for the monitoring of trade between the Community and third countries in drug precursors

not listed

National inventories

Substance is listed in the following national inventories:

Country	National inventories	Status
AU	AICS	substance is listed
CA	DSL	substance is listed
CN	IECSC	substance is listed
EU	ECSI	substance is listed
EU	REACH Reg.	substance is listed
JP	CSCL-ENCS	substance is listed
JP	ISHA-ENCS	substance is listed
KR	KECI	substance is listed
MX	INSQ	substance is listed
NZ	NZIOC	substance is listed
PH	PICCS	substance is listed
TW	TCSI	substance is listed
US	TSCA	substance is listed

Legend

Legena	
AICS	Australian Inventory of Chemical Substances
CSCL-ENCS	List of Existing and New Chemical Substances (CSCL-ENCS)
DSL	Domestic Substances List (DSL)
ECSI	EC Substance Inventory (EINECS, ELINCS, NLP)
IECSC	Inventory of Existing Chemical Substances Produced or Imported in China
INSQ	National Inventory of Chemical Substances
ISHA-ENCS	Inventory of Existing and New Chemical Substances (ISHA-ENCS)
KECI	Korea Existing Chemicals Inventory
NZIoC	New Zealand Inventory of Chemicals
PICCS	Philippine Inventory of Chemicals and Chemical Substances
REACH Reg.	REACH registered substances
TCSI	Taiwan Chemical Substance Inventory
TSCA	Toxic Substance Control Act

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

Abbreviations and acronyms

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Abbr.	Descriptions of used abbreviations
2000/39/EC	Comission Directive establishing a first list of indicative occupational exposure limit values in implementa- tion of Council Directive 98/24/EC
ADN	Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
ADR	Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
BCF	bioconcentration factor
CAS	Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or toxic for Reproduction
DGR	Dangerous Goods Regulations (see IATA/DGR)
DMEL	Derived Minimal Effect Level
DNEL	Derived No-Effect Level
EH40/2005	EH40/2005 Workplace exposure limits (http://www.nationalarchives.gov.uk/doc/open-government-licence/)
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances
EmS	Emergency Schedule
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations
IATA	International Air Transport Association
IATA/DGR	Dangerous Goods Regulations (DGR) for the air transport (IATA)
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods Code
index No	the Index number is the identification code given to the substance in Part 3 of Annex VI to Regulation (EC) No 1272/2008
IOELV	indicative occupational exposure limit value
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of "Marine Pollutant")
NLP	No-Longer Polymer
PBT	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No-Effect Concentration
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)
STEL	short-term exposure limit
SVHC	Substance of Very High Concern
TWA	time-weighted average
VOC	Volatile Organic Compounds
vPvB	very Persistent and very Bioaccumulative
WEL	workplace exposure limit

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Key literature references and sources for data

- Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU Regulation (EC) No. 1272/2008 (CLP, EU GHS) Dangerous Goods Regulations (DGR) for the air transport (IATA)

- International Maritime Dangerous Goods Code (IMDG)

List of relevant phrases (code and full text as stated in chapter 2 and 3)

Code	Text
H226	flammable liquid and vapour
H304	may be fatal if swallowed and enters airways
H312	harmful in contact with skin
H315	causes skin irritation
H319	causes serious eye irritation
H332	harmful if inhaled
H335	may cause respiratory irritation
H373	may cause damage to organs (respiratory system, nervous system) through prolonged or repeated expos- ure

Disclaimer

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.





Health	2
Fire	2
Reactivity	0
Personal Protection	E

Material Safety Data Sheet Naphthalene MSDS

Section 1: Chemical Product and Company Identification

Product Name: Naphthalene Catalog Codes: SLN1789, SLN2401 CAS#: 91-20-3 RTECS: QJ0525000 TSCA: TSCA 8(b) inventory: Naphthalene Cl#: Not available. Synonym: Chemical Name: Not available. Chemical Formula: C10H8

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: **1-800-901-7247** International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Naphthalene	91-20-3	100

Toxicological Data on Ingredients: Naphthalene: ORAL (LD50): Acute: 490 mg/kg [Rat]. 533 mg/kg [Mouse]. 1200 mg/kg [Guinea pig]. DERMAL (LD50): Acute: 20001 mg/kg [Rabbit]. VAPOR (LC50): Acute: 170 ppm 4 hour(s) [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of ingestion. Hazardous in case of eye contact (irritant), of inhalation. Slightly hazardous in case of skin contact (irritant, permeator). Severe over-exposure can result in death.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Cold water may be used. Do not use an eye ointment. Seek medical attention.

Skin Contact:

After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact: Not available.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do not induce vomiting. Examine the lips and mouth to ascertain whether the tissues are damaged, a possible indication that the toxic material was ingested; the absence of such signs, however, is not conclusive. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 567°C (1052.6°F)

Flash Points: CLOSED CUP: 88°C (190.4°F). OPEN CUP: 79°C (174.2°F).

Flammable Limits: LOWER: 0.9% UPPER: 5.9%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Not available.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards: Not available.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Flammable solid. Stop leak if without risk. Do not touch spilled material. Use water spray curtain to divert vapor drift. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If ingested, seek medical advice immediately and show the container or the label. Keep away from incompatibles such as oxidizing agents.

Storage:

Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. Keep container dry. Keep in a cool place.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

Israel: TWA: 10 (ppm) TWA: 10 STEL: 15 (ppm) from ACGIH (TLV) [1995] TWA: 52 STEL: 79 (mg/m3) from ACGIH [1995] Australia: STEL: 15 (ppm) Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Crystalline solid.)

Odor: Aromatic.

Taste: Not available.

Molecular Weight: 128.19 g/mole

Color: White.

pH (1% soln/water): Not available.

Boiling Point: 218°C (424.4°F)

Melting Point: 80.2°C (176.4°F)

Critical Temperature: Not available.

Specific Gravity: 1.162 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 4.4 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.038 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties:

Partially dispersed in hot water, methanol, n-octanol. Very slightly dispersed in cold water. See solubility in methanol, n-octanol.

Solubility:

Partially soluble in methanol, n-octanol. Very slightly soluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Highly reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: May attack some forms of rubber and plastic

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

WARNING: THE LC50 VALUES HEREUNDER ARE ESTIMATED ON THE BASIS OF A 4-HOUR EXPOSURE. Acute oral toxicity (LD50): 490 mg/kg [Rat]. Acute dermal toxicity (LD50): 20001 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 170 ppm 4 hour(s) [Rat].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH. DEVELOPMENTAL TOXICITY: Classified Development toxin [POSSIBLE]. The substance is toxic to blood, kidneys, the nervous system, the reproductive system, liver, mucous membranes, gastrointestinal tract, upper respiratory tract, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant, permeator).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans: Not available.

Section 12: Ecological Information

Ecotoxicity: Ecotoxicity in water (LC50): 305.2 ppm 96 hour(s) [Trout].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: CLASS 4.1: Flammable solid.

Identification: : Naphthalene, refined : UN1334 PG: III

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:

Rhode Island RTK hazardous substances: Naphthalene Pennsylvania RTK: Naphthalene Florida: Naphthalene Minnesota: Naphthalene Massachusetts RTK: Naphthalene TSCA 8(b) inventory: Naphthalene TSCA 8(a) PAIR: Naphthalene TSCA 8(d) H and S data reporting: Naphthalene: 06/01/87 SARA 313 toxic chemical notification and release reporting: Naphthalene: 1% CERCLA: Hazardous substances.: Naphthalene: 100 lbs. (45.36 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS B-4: Flammable solid. CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):

R36- Irritating to eyes. R40- Possible risks of irreversible effects. R48/22- Harmful: danger of serious damage to health by prolonged exposure if swallowed. R48/23- Toxic: danger of serious damage to health by prolonged exposure through inhalation. R63- Possible risk of harm to the unborn child.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 2

Reactivity: 0

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/11/2005 01:30 PM

Last Updated: 11/06/2008 12:00 PM

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Safety data sheet according to 1907/2006/EC, Article 31

Printing date 24.08.2020

Version number 1

Revision: 24.08.2020

SECTION 1: Identification of the substance/mixture and of the company/undertaking

· 1.1 Product identifier

· Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

- · Part number: DRE-C13342360
- CAS Number: 1691-99-2
- · EC number:
- 216-887-4

 1.2 Relevant identified uses of the substance or mixture and uses advised against No further relevant information available.
 Application of the substance / the mixture Reference material for laboratory use only

- Application of the substance r the mixture Reference material for tabora
- \cdot 1.3 Details of the supplier of the safety data sheet
- Manufacturer/Supplier: LGC Limited Queens Road Teddington Middlesex TW11 0LY UNITED KINGDOM

Further information obtainable from: Product safety department eMail : sds-request@lgcgroup.com
1.4 Emergency telephone number: For Hazardous Materials or Dangerous Goods Incident Spill, Leak, Fire Exposure, or Accident Call CHEMTREC: USA & Canada 1-800-424-9300 Rest of the world +1 703-741-5970 Tel :+44 (0) 20 8943 7000 Fax :+44 (0) 20 8943 2767 eMail : gb@lgcstandards.com Web : www.lgcstandards.com

SECTION 2: Hazards identification

2.1 Classificatio	on of the substanc ccording to Regul	e or mixture lation (EC) No 1272/2008 bones
Acute Tox. 3	H301	Toxic if swallowed.
GHS0)8 health hazard	
Carc. 2	H351	Suspected of causing cancer.
Repr. 1B	H360D-H362	May damage the unborn child. May cause harm to breast-fed children.
STOT RE 1	<i>H372</i>	Causes damage to organs through prolonged or repeated exposure. (Contd. on page 2)



Safety data sheet according to 1907/2006/EC, Article 31

Printing date 24.08.2020

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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide



(Contd. on page 3)



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Safety data sheet according to 1907/2006/EC, Article 31

Printing date 24.08.2020

Version number 1

Revision: 24.08.2020

Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

(Contd. from page 2)

SECTION 3: Composition/information on ingredients

- · 3.1 Chemical characterisation: Substances
- · CAS No. Description
- 1691-99-2 N-Ethyl perfluorooctane sulfonamide ethanol
- · Identification number(s) None
- · EC number: 216-887-4
- **RTECS:** RG9701350
- Additional information: For the wording of the listed hazard phrases refer to section 16.

SECTION 4: First aid measures

- 4.1 Description of first aid measures
- General information:
- Immediately remove any clothing soiled by the product.

Symptoms of poisoning may occur even after several hours; therefore medical observation for at least 48 hours after the accident is recommended.

In case of irregular breathing or respiratory arrest provide artificial respiration.

- After inhalation:
- Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.

In case of unconsciousness place patient in recovery position for transport. Seek medical treatment.

- After skin contact: Immediately wash with water and soap and rinse thoroughly.
- After eye contact: Rinse opened eye for several minutes under running water. Then consult a doctor.
- After swallowing:
- *Rinse mouth. Do not induce vomiting.*
- Call for a doctor immediately.
- 4.2 Most important symptoms and effects, both acute and delayed No further relevant information available.
- 4.3 Indication of any immediate medical attention and special treatment needed
- No further relevant information available.

SECTION 5: Firefighting measures

- · 5.1 Extinguishing media
- Suitable extinguishing agents: Use fire extinguishing methods suitable for surrounding conditions.
- · 5.2 Special hazards arising from the substance or mixture
- Formation of toxic gases is possible during heating or in case of fire.
- · 5.3 Advice for firefighters
- · Protective equipment:
- Mouth respiratory protective device.

Wear self-contained respiratory protective device.

(Contd. on page 4)



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Safety data sheet according to 1907/2006/EC, Article 31

Printing date 24.08.2020

Version number 1

Revision: 24.08.2020

Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

(Contd. from page 3)

SECTION 6: Accidental release measures

- \cdot 6.1 Personal precautions, protective equipment and emergency procedures Avoid formation of dust.
- · 6.2 Environmental precautions:

Inform respective authorities in case of seepage into water course or sewage system. Do not allow to enter sewers/ surface or ground water.

- 6.3 Methods and material for containment and cleaning up: Dispose of contaminated material as waste according to item 13. Ensure adequate ventilation.
- 6.4 Reference to other sections
 See Section 7 for information on safe handling.
 See Section 8 for information on personal protection equipment.
 See Section 13 for disposal information.

SECTION 7: Handling and storage

· 7.1 Precautions for safe handling

Ensure good ventilation/extraction at the workplace. Remove dust thoroughly. Store in cool, dry place in tightly closed receptacles.

· Information about fire - and explosion protection: No special measures required.

· 7.2 Conditions for safe storage, including any incompatibilities

· Storage:

· Requirements to be met by storerooms and receptacles:

Please refer to the manufacturer's certificate for specific storage and transport temperature conditions. Store only in the original receptacle unless other advice is given on the CoA.

- Keep container in a well-ventilated place. Keep away from sources of ignition and heat.
- · Information about storage in one common storage facility: Store away from foodstuffs.
- Further information about storage conditions: Keep container tightly sealed.
- 7.3 Specific end use(s) No further relevant information available.

SECTION 8: Exposure controls/personal protection

• Additional information about design of technical facilities: No further data; see item 7.

· 8.1 Control parameters

- Ingredients with limit values that require monitoring at the workplace: Not required.
- · Additional information: Lists used were valid at the time of SDS preparation.
- · 8.2 Exposure controls
- · Personal protective equipment:
- General protective and hygienic measures: Keep away from foodstuffs, beverages and feed. Immediately remove all soiled and contaminated clothing Wash hands before breaks and at the end of work. Store protective clothing separately.

(Contd. on page 5)

GB



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Safety data sheet according to 1907/2006/EC, Article 31

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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

(Contd. from page 4)

• *Respiratory protection:* In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use self-contained respiratory protective device.

• Protection of hands:

The glove material has to be impermeable and resistant to the product/ the substance/ the preparation. Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

The protective gloves to be used must comply with the specifications of EC Directive 89/686/EEC and the related standard EN374



Protective gloves

- · Material of gloves Fluorocarbon rubber (Viton)
- · Penetration time of glove material

The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· Eye protection:



Tightly sealed goggles

SECTION 9: Physical and chemical properties

• 9.1 Information on basic physical and • General Information	l chemical properties	
· Appeurunce: Form:	Solid	
Colour:	White	
· Odour:	Odourless	
· Odour threshold:	Not determined.	
· pH-value:	Not applicable.	
• Change in condition Melting point/freezing point: Initial boiling point and boiling rang	55-60 °C ge: Not determined.	
· Flash point:	Not applicable.	
· Flammability (solid, gas):	Not determined.	
· Ignition temperature:	Not determined	
· Decomposition temperature:	Not determined.	
• Auto-ignition temperature:	Not determined.	
		(Contd. on page 6)



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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

	(Contd. from page 5)
· Explosive properties:	Not determined.
· Explosion limits:	
Lower:	Not determined.
Upper:	Not determined.
· Vapour pressure:	Not applicable.
· Density:	Not determined.
· Relative density	Not determined.
· Vapour density	Not applicable.
· Evaporation rate	Not applicable.
· Solubility in / Miscibility with	Chloroform (Slightly), DMSO, Ethyl Acetate (Slightly), Methanol (Slightly)
· water:	Not determined.
· Partition coefficient: n-octanol/water:	Not determined.
· Viscosity:	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
 9.2 Other information 	No further relevant information available.

SECTION 10: Stability and reactivity

· 10.1 Reactivity

Stable under normal conditions.

No further relevant information available.

- · 10.2 Chemical stability Stable under normal conditions.
- Thermal decomposition / conditions to be avoided:
- Formation of toxic gases is possible during heating or in case of fire.
- 10.3 Possibility of hazardous reactions No dangerous reactions known.
- 10.4 Conditions to avoid Heat.
- 10.5 Incompatible materials: Strong oxidizing agents.
- · 10.6 Hazardous decomposition products:

Formation of toxic gases is possible during heating or in case of fire.

SECTION 11: Toxicological information

- · 11.1 Information on toxicological effects
- · Acute toxicity

Toxic if swallowed.

- Harmful if inhaled. • Primary irritant effect:
- · Skin corrosion/irritation Based on available data, the classification criteria are not met.
- · Serious eye damage/irritation Based on available data, the classification criteria are not met.
- · Respiratory or skin sensitisation Based on available data, the classification criteria are not met.

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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

- CMR effects (carcinogenity, mutagenicity and toxicity for reproduction) Carc. 2, Repr. 1B
- · Germ cell mutagenicity Based on available data, the classification criteria are not met.
- · Carcinogenicity
- Suspected of causing cancer.
- **Reproductive toxicity** May damage the unborn
- May damage the unborn child. May cause harm to breast-fed children.
- · STOT-single exposure Based on available data, the classification criteria are not met.
- · STOT-repeated exposure
- Causes damage to organs through prolonged or repeated exposure.
- Aspiration hazard Based on available data, the classification criteria are not met.

SECTION 12: Ecological information

- · 12.1 Toxicity
- Aquatic toxicity: No further relevant information available.
- 12.2 Persistence and degradability No further relevant information available.
- \cdot 12.3 Bioaccumulative potential No further relevant information available.
- 12.4 Mobility in soil No further relevant information available.
- · Ecotoxicological effects:
- Remark: Toxic for fish
- \cdot Additional ecological information:
- · General notes:

Water hazard class 3 (German Regulation) (Self-assessment): extremely hazardous for water Do not allow product to reach ground water, water course or sewage system, even in small quantities. Danger to drinking water if even extremely small quantities leak into the ground. Also poisonous for fish and plankton in water bodies.

- Toxic for aquatic organisms
- · 12.5 Results of PBT and vPvB assessment
- **PBT:** Not applicable.
- · vPvB: Not applicable.
- · 12.6 Other adverse effects No further relevant information available.

SECTION 13: Disposal considerations

- · 13.1 Waste treatment methods
- · Recommendation
- Must not be disposed of together with household garbage. Do not allow product to reach sewage system.
- \cdot European waste catalogue
- Waste disposal key numbers from EWC have to be assigned depending on origin and processing.
- · Uncleaned packaging:
- **Recommendation:** Dispose of in accordance with national regulations.

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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

(Contd. from page 7)

SECTION 14: Transport information	
· 14.1 UN-Number · ADR, IMDG, IATA · ADR	UN2811 2811 TOXIC SOLID, ORGANIC, N.O.S. (N-Ethyl perfluorooctane sulfonamide ethanol).
·IMDG	ENVIRONMENTALLY HAZARDOUS TOXIC SOLID, ORGANIC, N.O.S. (N-Ethyl perfluorooctane sulfonamide ethanol), MARINE POLLUTANT
·IATA	TOXIC SOLID, ORGANIC, N.O.S. (N-Ethyl perfluorooctane sulfonamide ethanol)
· 14.3 Transport hazard class(es)	
· ADR, IMDG	
· Class	6.1 Toxic substances.
· Label	6.1
· Class	6.1 Toxic substances.
· Label	6.1
· 14.4 Packing group · ADR, IMDG, IATA	III
· 14.5 Environmental hazards:	Environmentally hazardous substance, solid; Marine Pollutant
· Marine pollutant:	Symbol (fish and tree)
· Special marking (ADK):	Symbol (fish and tree)
· 14.6 Special precautions for user Danger code (Kemler):	Warning: Toxic substances.
· EMS Number:	F-A,S-A
· Stowage Category	Α
• 14.7 Transport in bulk according to Annex II o Marpol and the IBC Code	f Not applicable.
	(Contd. on page 9



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Product name: N-Ethyl-N-(2-hydroxyethyl)perfluorooctanesulfonamide

	(Contd. from page 8
· Transport/Additional information:	
· ADR	
\cdot Limited quantities (LQ)	5 kg
\cdot Excepted quantities (\widetilde{EQ})	Code: E1
	Maximum net quantity per inner packaging: 30 g
	Maximum net quantity per outer packaging: 1000 g
· Transport category	2
· Tunnel restriction code	E
· UN "Model Regulation":	UN 2811 TOXIC SOLID, ORGANIC, N.O.S. (N-ETHY) PERFLUOROOCTANE SULFONAMIDE ETHANOL), 6.1 III, ENVIRONMENTALLY HAZARDOUS

SECTION 15: Regulatory information

· 15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture

- · Directive 2012/18/EU
- · Named dangerous substances ANNEX I Substance is not listed.
- · Seveso category E2 Hazardous to the Aquatic Environment
- Qualifying quantity (tonnes) for the application of lower-tier requirements 200 t
- \cdot Qualifying quantity (tonnes) for the application of upper-tier requirements 500 t
- **Regulation (EU) No 649/2012** Annex I Part 1

Annex I Part 3

· 15.2 Chemical safety assessment: A Chemical Safety Assessment has not been carried out.

SECTION 16: Other information

The information in this safety data sheet (SDS) has been prepared with due care and is true and accurate to the best of our knowledge. The user must determine the suitability of the information for its particular purpose, ensure compliance with existing laws and regulations, and be aware that other or additional safety or performance considerations may arise when using, handling and/ or storing the material. The information in this SDS does not purport to be all inclusive or a guarantee as to the properties of the material supplied, and should be used only as a guide. LGC makes no warranties or representations as to the accuracy and completeness of the information contained herein, shall not be held responsible for the suitability of this information for the user's intended purposes or the consequences of such use, and shall not be liable for any damage or loss, howsoever arising, direct or otherwise.

· Abbreviations and acronyms:

ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road) IMDG: International Maritime Code for Dangerous Goods

IMDG: International Maritime Code for Dangerous Good IATA: International Air Transport Association

GHS: Globally Harmonised System of Classification and Labelling of Chemicals

EINECS: European Inventory of Existing Commercial Chemical Substances

CAS: Chemical Abstracts Service (division of the American Chemical Society)

PBT: Persistent, Bioaccumulative and Toxic

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vPvB: very Persistent and very Bioaccumulative Acute Tox. 3: Acute toxicity – Category 3 Acute Tox. 4: Acute toxicity – Category 4 Carc. 2: Carcinogenicity – Category 2 Repr. 1B: Reproductive toxicity – Category 1B STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1 Aquatic Chronic 2: Hazardous to the aquatic environment - long-term aquatic hazard – Category 2 **Sources** Tables 3.1 and 3.2 from Annex 6 of EC 1272/2008 EC 1907/2006 EH40/2005 as c

Tables 3.1 and 3.2 from Annex 6 of EC 1272/2008, EC 1907/2006, EH40/2005 as amended 2011, Registry of Toxic Effects of Chemical Substances (RTECS), The Dictionary of Substances and their Effects, 1st Edition, IUCLID.

• <u>Data compared to the previous version altered.</u> All sections have been updated.



SAFETY DATA SHEET

Creation Date 26-Oct-2009 Revision Date 02-Apr-2014 **Revision Number 1** 1. Identification Product Name n-Hexane Cat No. : AC326920000; AC326920010; AC326920025; AC326921000; AC326922500 **Synonyms** Hex **Recommended Use** Laboratory chemicals Uses advised against No Information available Details of the supplier of the safety data sheet **Entity / Business Name Emergency Telephone Number** Company Fisher Scientific Acros Organics For information US call: 001-800-ACROS-01 / One Reagent Lane One Reagent Lane Europe call: +32 14 57 52 11 Fair Lawn, NJ 07410 Fair Lawn, NJ 07410 Emergency Number US:001-201-796-7100 / Tel: (201) 796-7100 Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 /

2. Hazard(s) identification

Europe:001-703-527-3887

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Reproductive Toxicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system, Central nervous syst	em (CNS).
Specific target organ toxicity - (repeated exposure)	Category 1
Target Organs - Liver, Heart, Blood.	
Aspiration Toxicity	Category 1

Label Elements

Signal Word Danger

Hazard Statements Highly flammable liquid and vapor

May be fatal if swallowed and enters airways Causes skin irritation Causes serious eye irritation May cause respiratory irritation May cause drowsiness or dizziness Suspected of damaging fertility Causes damage to organs through prolonged or repeated exposure



Precautionary Statements Prevention

Obtain special instructions before use

Do not handle until all safety precautions have been read and understood

Use personal protective equipment as required

Wash face, hands and any exposed skin thoroughly after handling

Wear eye/face protection

Do not breathe dust/fume/gas/mist/vapors/spray

Do not eat, drink or smoke when using this product

Use only outdoors or in a well-ventilated area

Keep away from heat/sparks/open flames/hot surfaces. - No smoking

Keep container tightly closed

Ground/bond container and receiving equipment

Use explosion-proof electrical/ventilating/lighting/equipment

Use only non-sparking tools

Take precautionary measures against static discharge

Keep cool

Response

IF exposed or concerned: Get medical attention/advice

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

If skin irritation occurs: Get medical advice/attention

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower

Wash contaminated clothing before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention.

Ingestion

IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician

Do NOT induce vomiting

Fire

In case of fire: Use CO2, dry chemical, or foam for extinction

Storage

Store locked up

Store in a well-ventilated place. Keep container tightly closed

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Haz/Non-haz			
Component		CAS-No	Weight %
Hexane	110-54-3		>95
	4. First-aid m	neasures	
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.		
Skin Contact	Wash off immediately with pler	ty of water for at leas	t 15 minutes. Obtain medical attention.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Obtain medical attention. Aspiration into lungs can produce severe lung damage.		
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately. If vomiting occurs, lean victim forward to reduce the risk of aspiration.		
Most important symptoms/effects	Breathing difficulties Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting.		
Notes to Physician	Treat symptomatically.		
	5. Fire-fighting	measures	
Suitable Extinguishing Media	CO ₂ , dry chemical, dry sand, a with water spray.	cohol-resistant foam.	Cool closed containers exposed to fire
Unsuitable Extinguishing Media	Water may be ineffective, This could easily be spread by the u	material is lighter tha use of water in an area	n water and insoluble in water. The fire a where the water cannot be contained.
Flash Point	-22°C / -7.6°F		
Method -	No information available		
Autoignition Temperature	223°C / 433.4°F		
Explosion Limits Upper Lower	7.5 vol % 1.1 vol %		
Sensitivity to Mechanical Impact Sensitivity to Static Discharge	No information available		

Specific Hazards Arising from the Chemical

Flammable. Risk of ignition. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated.

Hazardous Combustion Products Carbon monoxide (CO), Carbon dioxide (CO₂).

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA			
Health	Flammability	Instability	Physical hazards
2	3	0	IN/A
	6. Accidental re	lease measures	
Personal Precautions	Use personal protective equareas. Remove all sources	uipment. Ensure adequate vent of ignition. Take precautionary	ilation. Evacuate personnel to safe measures against static discharges.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. Avoid release to the environment. Collect spillage.		
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Take precautionary measures against static discharges.		
	7. Handling	and storage	
Handling	Wear personal protective en breathe vapors or spray mis ignition. Use only non-spark measures against static dis all metal parts of the equipm	quipment. Do not get in eyes, o st. Keep away from open flames king tools. Use explosion-proof charges. To avoid ignition of va nent must be grounded.	n skin, or on clothing. Do not s, hot surfaces and sources of equipment. Take precautionary apors by static electricity discharge,
Storage	Keep containers tightly clos and sources of ignition. Flan	ed in a dry, cool and well-ventil mmables area.	ated place. Keep away from heat

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Hexane	TWA: 50 ppm Skin	(Vacated) TWA: 50 ppm (Vacated) TWA: 180 mg/m ³ TWA: 500 ppm TWA: 1800 mg/m ³	IDLH: 1100 ppm TWA: 50 ppm TWA: 180 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Hexane	TWA: 50 ppm TWA: 176 mg/m³ Skin	TWA: 50 ppm TWA: 176 mg/m ³	TWA: 50 ppm Skin

Legend

ACGIH - American Conference of Governmental Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering MeasuresEnsure adequate ventilation, especially in confined areas. Ensure that eyewash stations and
safety showers are close to the workstation location. Use explosion-proof
electrical/ventilating/lighting/equipment.Personal Protective EquipmentWear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's
eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.Skin and body protectionWear appropriate protective gloves and clothing to prevent skin exposure.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice
Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or Europear 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if are exceeded or if irritation or other symptoms are experienced

Physical State
Appearance
Odor
Odor Threshold
рН
Melting Point/Range
Boiling Point/Range
Flash Point
Evaporation Rate
Flammability (solid,gas)
Flammability or explosive limits
Upper
Lower
Vapor Pressure
Vapor Density
Relative Density
Solubility
Partition coefficient; n-octanol/water
Autoignition Temperature
Decomposition temperature
Viscosity
Molecular Formula
Molecular Weight

Colorless Petroleum distillates No information available. No information available. -95°C / -139°F 69°C / 156.2°F@ 760 mmHg -22°C / -7.6°F No information available. Not applicable 7.5 vol % 1.1 vol % 160 mbar @ 20 °C 2.97 0.659 Insoluble in water No data available 223°C / 433.4°F No information available. 0.31 mPa s at 20 °C C6 H14 86.18

10. Stability and reactivity

Reactive Hazard	None known, based on information available.
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Heat, flames and sparks. Exposure to light. Keep away from open flames, hot surfaces and sources of ignition.
Incompatible Materials	Strong oxidizing agents, Halogens
Hazardous Decomposition Products	Carbon monoxide (CO), Carbon dioxide (CO ₂)
Hazardous Polymerization	Hazardous polymerization does not occur
Hazardous Reactions	None under normal processing

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Hexane	25 g/kg (Rat)	3000 mg/kg (Rabbit)	48000 ppm (Rat) 4 h

Toxicologically Syn Products	ergistic	No information available.								
Delayed and immed	iate effects as w	ell as chronic effects from short and long-term exposure								
Irritation		Irritating to eyes and	Irritating to eyes and skin							
Sensitization										
Carcinogenicity		The table below indicates whether each agency has listed any ingredient as a carcinogen								
Component	CAS-No	IARC	OSHA	Mexico						
Hexane	110-54-3	Not listed	Not listed	Not listed	Not listed	Not listed				
Reproductive Effect Developmental Effect Teratogenicity	s cts	Experiments have shown reproductive toxicity effects on laboratory animals. Developmental effects have occurred in experimental animals. Teratogenic effects have occurred in experimental animals								
STOT - single exposure Respiratory system, Central nervous system (CNS).										
STOT - repeated exposure Liver, Heart, Blood.										
Aspiration hazard		No information available.								
Symptoms / effects, both acute and dela	yed	Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting.								
Endocrine Disrupto	ndocrine Disruptor Information No information available									
Other Adverse Effects Tumorigenic effects have been reported in experimental animals See actual e					I entry in RTECS					

12. Ecological information

Ecotoxicity

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea	
Hexane	Hexane Not listed 2		Not listed	EC50: 3.87 mg/L/48h	
Persistence and Degrada	bility Persistence	is unlikely, based on informa	ation available.		
Bioaccumulation/ Accum	ulation No information	on available			
MobilityWill likely be mobile in the environment due to its volatility.					
Component			log Pow		
		4.11			

13. Disposal considerations

Waste Disposal Methods

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

UN-No Proper Shipping Name Hazard Class Packing Group	UN1208 Hexanes 3 II
UN-No Proper Shipping Name Hazard Class Packing Group	UN1208 HEXANES 3 II
UN-No Proper Shipping Name Hazard Class Packing Group	UN1208 Hexanes 3 II
/IMO	
UN-No Proper Shipping Name Hazard Class Packing Group	UN1208 Hexanes 3 II
	UN-No Proper Shipping Name Hazard Class Packing Group UN-No Proper Shipping Name Hazard Class Packing Group UN-No Proper Shipping Name Hazard Class Packing Group //MO UN-No Proper Shipping Name Hazard Class Packing Group

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Hexane	Х	Х	-	203-777-6	-		Х	Х	Х	Х	Х

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Hexane	110-54-3	>95	1.0
SARA 311/312 Hazardous Categorization			
---------------------------------------	-----		
Acute Health Hazard	Yes		
Chronic Health Hazard	Yes		
Fire Hazard	Yes		
Sudden Release of Pressure Hazard	No		
Reactive Hazard	No		

Clean Water Act Not applicable

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Hexane	Х		-

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Hexane	5000 lb	-

California Proposition 65

This product does not contain any Proposition 65 chemicals.

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Hexane	Х	Х	Х	Х	Х

U.S. Department of Transportation

Reportable Quantity (RQ):	Υ
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

Serious risk, Grade 3

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR.

WHMIS Hazard Class

B2 Flammable liquid D2A Very toxic materials



16. Other information

Prepared By	Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com
Creation Date Revision Date Print Date Revision Summary	26-Oct-2009 02-Apr-2014 02-Apr-2014 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



SAFETY DATA SHEET

Creation Date 04-Oct-2010

Revision Date 10-Feb-2015

Revision Number 1

1. Identification

Product Name

AC193610000; AC193610250; AC193611000; AC193615000

Synonyms

Cat No. :

Raney alloy

Nickel, powder

Recommended Use Laboratory chemicals.

Uses advised against No Information available Details of the supplier of the safety data sheet

Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100 Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410 Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Sensitization Carcinogenicity Specific target organ toxicity - (repeated exposure) Target Organs - Kidney, Blood.

Category 1 Category 2 Category 1

Label Elements

Signal Word Danger

Hazard Statements

May cause an allergic skin reaction Causes damage to organs through prolonged or repeated exposure Suspected of causing cancer



Precautionary Statements

Prevention

Obtain special instructions before use Do not handle until all safety precautions have been read and understood Wear protective gloves/protective clothing/eye protection/face protection Do not breathe dust/fume/gas/mist/vapors/spray Wash face, hands and any exposed skin thoroughly after handling Do not eat, drink or smoke when using this product Contaminated work clothing should not be allowed out of the workplace Response IF exposed or concerned: Get medical attention/advice Skin IF ON SKIN: Wash with plenty of soap and water If skin irritation or rash occurs: Get medical advice/attention Wash contaminated clothing before reuse Storage Store locked up Disposal Dispose of contents/container to an approved waste disposal plant Hazards not otherwise classified (HNOC) Harmful to aquatic life with long lasting effects

3. Composition / information on ingredients

Component	CAS-No	Weight %
Nickel powder	7440-02-0	>95

	4. FIrst-aid measures		
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.		
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.		
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.		
Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.		
Most important symptoms/effects	May cause allergic skin reaction. Symptoms of allergic reaction may include rash, itching, swelling, trouble breathing, tingling of the hands and feet, dizziness, lightheadedness, chest pain, muscle pain or flushing		
Notes to Physician	Treat symptomatically		
	5. Fire-fighting measures		
Suitable Extinguishing Media	Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.		
Unsuitable Extinguishing Media	No information available		
Flash Point Method -	No information available		
Explosion Limits	400 °C / 752 °F		
Upper Lower	No data available No data available		

Sensitivity to Mechanical Impact No information available Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical

Combustible material.

Hazardous Combustion Products

Nickel oxides.

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

<u>NFPA</u> Health 3	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental re	lease measures	
Personal Precautions	Ensure adequate ventilation and upwind of spill/leak. E	on. Use personal protective eq vacuate personnel to safe are	uipment. Keep people away from as. Avoid dust formation.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.		
Methods for Containment and Up	Clean Sweep up or vacuum up s formation.	pillage and collect in suitable o	container for disposal. Avoid dust
	7. Handling	and storage	
Handling	Use only under a chemica eyes, on skin, or on clothir ingest.	l fume hood. Wear personal p ng. Avoid dust formation. Do n	rotective equipment. Do not get in ot breathe vapors/dust. Do not

Storage

Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Nickel powder	TWA: 1.5 mg/m ³	(Vacated) TWA: 1 mg/m ³ TWA: 1 mg/m ³	IDLH: 10 mg/m ³ TWA: 0.015 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Nickel powder	TWA: 1 mg/m ³	TWA: 1 mg/m ³	TWA: 1 mg/m ³

<u>Legend</u>

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures	Use only under a chemical fume hood. Ensure that eyewash stations and safety showers are close to the workstation location.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.				
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.				
9	Physical and chemical properties				
Physical State	Solid				
Appearance	Brown				
Odor	Odorless				
Odor Threshold	No information available				
pH	No information available				
Melting Point/Range	1455 °C / 2651 °F				
Boiling Point/Range	2730 °C / 4946 °F				
Flash Point	No information available				
Evaporation Rate	No information available				
Flammability (solid,gas)	No information available				
Flammability or explosive limits					
Upper	No data available				
Lower					
Vapor Pressure	1 mmHg @ 1810 °C				
Vapor Density Relative Density	No information available				
Relative Density	No information available				
Bartition coefficient: n-octanol/wate	No data available				
Autoignition Temperature					
Decomposition Temperature	No information available				
Viscosity	No information available				
Molecular Formula	Ni				
Molecular Weight	58.7				
	····				
	10 Stability and reactivity				

10. Stability and reactivity

Reactive Hazard	None known, based on information available		
Stability	Stable under normal conditions.		
Conditions to Avoid	Incompatible products. Excess heat. Avoid dust formation.		
Incompatible Materials	Strong oxidizing agents		
Hazardous Decomposition Products	Nickel oxides		
Hazardous Polymerization	Hazardous polymerization does not occur.		
Hazardous Reactions	None under normal processing.		

11. Toxicological information

Acute Toxicity

Component Information			
Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Nickel powder	9000 mg/kg (Rat)	Not listed	Not listed
Toxicologically Synergistic	No information available		
Products			
Delayed and immediate effects	s as well as chronic effects fror	n short and long-term exposure	<u>)</u>

Irritation

No information available

Sensitization

May cause sensitization by skin contact Nickel and nickel compounds may cause a form of dermatitis known as nickel itch. May cause an allergic skin reaction

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Nickel powder	7440-02-0	Group 2B	Reasonably	Not listed	Х	Not listed
			Anticipated			
IARC: (Internation	al Agency for Rese	earch on Cancer)	Group 2B -	Possibly Carcinogen	ic to Humans	
Mutagenic Effects		No information ava	ailable			
Reproductive Effect	s	No information ava	ailable.			
Developmental Effe	cts	No information ava	ailable.			
Teratogenicity		No information ava	ailable.			
STOT - single expos	sure	None known				
STOT - repeated ex	posure	Kidney Blood				
Aspiration hazard		No information ava	ailable			
Symptoms / effects delayed Endocrine Disrupto	,both acute and r Information	Symptoms of aller of the hands and for No information available	gic reaction may in eet, dizziness, ligh ailable	clude rash, itching theadedness, ches	, swelling, trouble at pain, muscle pai	breathing, tingling n or flushing
Other Adverse Effe	cts	See actual entry in	RTECS for compl	ete information.		

12. Ecological information

Ecotoxicity

Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Do not empty into drains. Harmful to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Nickel powder	0.18 mg/L EC50 = 72 h	10.4 mg/L LC50 96 h 1.3	Not listed	1 mg/L EC50 = 48 h 100
-	0.174 - 0.311 mg/L EC50 96	mg/L LC50 96 h 100 mg/L		mg/L EC50 > 48 h
	h	LC50 96 h		_
Persistence and Degrad	ability No information	n available		
Bioaccumulation/Accum	nulation No information	n available.		

Bioaccumulation/Accumulation

Mobility

No information available.

Waste Disposal Methods

13. Disposal considerations

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information					
DOT UN-No Proper Shipping Name Hazard Class Packing Group	UN3089 METAL POWDERS, FLAMMABLE, N.O.S. 4.1 II				
<u>TDG</u> UN-No Proper Shipping Name Hazard Class Packing Group <u>IATA</u>	UN3089 METAL POWDERS, FLAMMABLE, N.O.S. 4.1 II				

UN-No Proper Shipping Name Hazard Class Packing Group	3089 METAL POWDERS, FLAMMABLE, N.O.S. 4.1 II
IMDG/IMO	
UN-No	3089
Proper Shipping Name	METAL POWDERS, FLAMMABLE, N.O.S.
Hazard Class	4.1
Packing Group	II
	15 Regulatory informatio

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Nickel powder	Х	Х	-	231-111-4	-		Х	-	Х	Х	Х

n

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Nickel powder	7440-02-0	>95	0.1

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Nickel powder	-	-	Х	Х

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors				
Nickel powder	Х		-				

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive

Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component		Hazardous Substances RQs	CERCLA EHS RQs
Nickel powder		100 lb	-
California Proposition 65	This product	his product contains the following Proposition 65 chemicals:	

Component	CAS-No	California F	California Prop. 65 Pr		rop 65 NSRL		Category
Nickel powder	7440-02-0	Carcino	Carcinogen		-		Carcinogen
State Right-to-Know							
Component	Massachusetts	New Jersey	Penns	ylvania	Illinois		Rhode Island
Nickel powder	X	Х		<	Х		Х

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D2A Very toxic materials



16. Other information Prepared By Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com Creation Date 04-Oct-2010 10-Feb-2015 Print Date 04-Oct-2010 10-Feb-2015 10-Feb-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

replacing the current legislation under 29 CFR 1910.1200 to align with the Globally

Harmonized System of Classification and Labeling of Chemicals (GHS)

End of SDS

SIGMA-ALDRICH

1.

Material Safety Data Sheet

Version 4.0 Revision Date 07/28/2010 Print Date 12/27/2011

PRODUCT AND COMPANY IDENTIFICATION				
Product name	: Propylbenzene			
Product Number Brand	: P52407 : Aldrich			
Company	: Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA			
Telephone Fax Emergency Phone #	: +1 800-325-5832 : +1 800-325-5052 : (314) 776-6555			

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Combustible Liquid

Target Organs

Lungs, Eyes, Kidney

GHS Label elements, including precautionary statements

Danger

1

2

0

Pictogram

Signal word



•	-
Hazard statement(s)	
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
H335	May cause respiratory irritation.
H401	Toxic to aquatic life.
Precautionary statement(s)	

P261 Ave P301 + P310 IF S

Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray. IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Do NOT induce vomiting.

HMIS Classification

P331

Health hazard:	0
Chronic Health Hazard:	*
Flammability:	2
Physical hazards:	0
NFPA Rating	

Health hazard: Fire: Reactivity Hazard:

Potential Health Effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms	: 1-Phenylpropane			
Formula Molecular Weight	: C ₉ H ₁₂ : 120.19 g/mol			
CAS-No.	EC-No.	Index-No.	Concentration	
Propylbenzene				
103-65-1	203-132-9	601-024-00-X	-	

4. FIRST AID MEASURES

Ingestion

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing give artificial respiration Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIRE-FIGHTING MEASURES

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

Special protective equipment for fire-fighters

Wear self contained breathing apparatus for fire fighting if necessary.

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Keep in suitable, closed containers for disposal.

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid inhalation of vapour or mist.

Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Store in cool place.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

For prolonged or repeated contact use protective gloves.

Eye protection

Face shield and safety glasses

Skin and body protection

Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

	Form	liquid, clear
	Colour	colourless
Sa	afety data	
	рН	no data available
	Melting point	-99 °C (-146 °F) - lit.
	Boiling point	159 °C (318 °F) - lit.
	Flash point	42.0 °C (107.6 °F) - closed cup
	Ignition temperature	450 °C (842 °F)
	Lower explosion limit	0.8 %(V)
	Upper explosion limit	6 %(V)
	Density	0.862 g/cm3 at 25 °C (77 °F)
	Water solubility	slightly soluble

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid

Heat, flames and sparks.

Materials to avoid

Strong oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

11. TOXICOLOGICAL INFORMATION

Acute toxicity

LD50 Oral - rat - 6,040 mg/kg Remarks: Behavioral:Somnolence (general depressed activity).

LC50 Inhalation - rat - 2 h - 65000 ppm

Skin corrosion/irritation no data available

Serious eye damage/eye irritation no data available

Respiratory or skin sensitization no data available

Germ cell mutagenicity

no data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System) May cause respiratory irritation.

Specific target organ toxicity - repeated exposure (Globally Harmonized System) no data available

Aspiration hazard

May be fatal if swallowed and enters airways.

Potential health effects

Inhalation	May be harmful if inhaled. May cause respiratory tract irritation.
Ingestion	Aspiration hazard if swallowed - can enter lungs and cause damage. May be harmful if
	swallowed.
Skin	May be harmful if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

Signs and Symptoms of Exposure

Damage to the lungs., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Additional Information

RTECS: DA8750000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish

LC50 - Oncorhynchus mykiss (rainbow trout) - 1.55 mg/l - 96.0 h

Toxicity to daphnia Immobilization EC50 - Daphnia magna (Water flea) - 2 mg/l - 24 h and other aquatic invertebrates.

Persistence and degradability

no data available

Bioaccumulative potential no data available

Mobility in soil no data available

PBT and vPvB assessment no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.

Avoid release to the environment.

13. DISPOSAL CONSIDERATIONS

Product

This combustible material may be burned in a chemical incinerator equipped with an afterburner and scrubber. Observe all federal, state, and local environmental regulations. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN-Number: 2364 Class: 3 Packing group: III Proper shipping name: n-Propyl benzene Marine pollutant: No Poison Inhalation Hazard: No

IMDG

UN-Number: 2364 Class: 3 Packing group: III Proper shipping name: PROPYLBENZENE Marine pollutant: No

ΙΑΤΑ

UN-Number: 2364 Class: 3 Pack Proper shipping name: n-Propylbenzene

Packing group: III

EMS-No: F-E, S-D

15. REGULATORY INFORMATION

OSHA Hazards

Combustible Liquid

DSL Status

All components of this product are on the Canadian DSL list.

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

Propylbenzene	CAS-No. 103-65-1	Revision Date 2007-03-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Propylbenzene	103-65-1	2007-03-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Propylbenzene	103-65-1	2007-03-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

Copyright 2010 Sigma-Aldrich Co. License granted to make unlimited paper copies for internal use only. The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Co., shall not be held liable for any damage resulting from handling or from contact with the above product. See reverse side of invoice or packing slip for additional terms and conditions of sale.

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.7 Revision Date 05/27/2015 Print Date 04/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	o-Cresol		
	Product Number Brand Index-No.	:	C85700 Sigma-Aldrich 604-004-00-9		
	CAS-No.	:	95-48-7		
1.2	Relevant identified uses of the substance or mixture and uses advised against				
	Identified uses	:	Laboratory chemicals, Manufacture of substances		
1.3	Details of the supplier of the safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA		

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1.4 Emergency telephone number

Emergency Phone #	:	(314) 776-6555
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2. HAZARDS IDENTIFICATION

Telephone

Fax

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Acute toxicity, Dermal (Category 3), H311 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

: +1 800-325-5832

+1 800-325-5052

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Hazard statement(s)	
H301 + H311	Toxic if swallowed or in contact with skin
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H411	Toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P260	Do not breathe dust or mist.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.

Danger

P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
D201 + D210 + D220	protection.
P301 + P310 + P330	physician. Rinse mouth.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	:	2-Methylphenol
Formula	:	C ₇ H ₈ O
Molecular weight	:	108.14 g/mol
CAS-No.	:	95-48-7
EC-No.	:	202-423-8
Index-No.	:	604-004-00-9

Hazardous components

Component	Classification	Concentration
o-Cresol		
	Acute Tox. 3; Skin Corr. 1B; Eye Dam. 1; Aquatic Acute 2; Aquatic Chronic 2; H301 + H311, H314, H318, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.2

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Air and light sensitive. Keep in a dry place.

Storage class (TRGS 510): Non-combustible, acute toxic Cat. 1 and 2 / very toxic hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CÁS-No.	Value	Control parameters	Basis
o-Cresol	95-48-7	TWA	5.000000 ppm 22.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	Skin contact does contribute to exposure.		

TWA	5.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
Eye, skin, & Adopted valu are proposed 2010 Revisio See Notice o	Upper Respiratory ues or notations en d in the NIC on or addition to the of Intended Change	Tract irritation closed are those for which changes e notice of intended changes es (NIC)
TWA	Itaneous absorptio	n USA. NIOSH Recommended
	mg/m3	
TWA	20.000000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Upper Respiratory Tract irritation Not classifiable as a human carcinogen Danger of cutaneous absorption		

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 30 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: white
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	4.5 at 25.00000 g/l
e)	Melting point/freezing point	Melting point/range: 29 - 31 °C (84 - 88 °F) - lit
f)	Initial boiling point and boiling range	191 °C (376 °F) - lit.
g)	Flash point	81.0 °C (177.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 58 %(V) Lower explosion limit: 1.3 %(V)
k)	Vapour pressure	3.1 hPa (2.3 mmHg) at 60.0 °C (140.0 °F) 1.3 hPa (1.0 mmHg) at 38.2 °C (100.8 °F) 0.4 hPa (0.3 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	1.05 g/cm3 at 20.00 °C (68.00 °F)
n)	Water solubility	25 g/l at 20 °C (68 °F)
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	599.0 °C (1,110.2 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Ot No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Oxidizing agents

Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 121.0 mg/kg Remarks: Behavioral:Convulsions or effect on seizure threshold. Lungs, Thorax, or Respiration:Dyspnea. Gastrointestinal:Ulceration or bleeding from stomach.

LC50 Inhalation - Rat - 1 h - > 1,220 mg/m3 Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Eye:Lacrimation. Behavioral:Somnolence (general depressed activity).

LD50 Dermal - Rabbit - 890.0 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Severe skin irritation - 24 h (Draize Test)

Serious eye damage/eye irritation

Eyes - Rabbit Result: Severe eye irritation (Draize Test)

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: GO6300000

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, Central nervous system depression, Diarrhoea, Gastrointestinal disturbance

Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Leuciscus idus	(Golden orfe) - 10.00 mg/l - 96 h
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Toxicity to daphnia and Immobilization EC50 - Daphnia magna (Water flea) - 15.8 mg/l - 48 h other aquatic invertebrates

Toxicity to algae EC50 - SELENASTRUM - 100.00 mg/l - 72 h

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life with long lasting effects.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 3455 Class: 6.1 (8) Packing group: II Proper shipping name: Cresols, solid Reportable Quantity (RQ): 100 lbs Poison Inhalation Hazard: No IMDG UN number: 3455 Packing group: II EMS-No: F-A, S-B Class: 6.1 (8) Proper shipping name: CRESOLS, SOLID ΙΑΤΑ UN number: 3455 Class: 6.1 (8) Packing group: II Proper shipping name: Cresols, solid

CAS-No.

95-48-7

15. REGULATORY INFORMATION

SARA 302 Components

The following components are subject to reporting levels established by SARA Title III, Section 302:

o-Cresol

Revision Date

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

o-Cresol 95-48-7 20	007-07-01
Massachusetts Right To Know Components	
CAS-No. Re	evision Date
o-Cresol 95-48-7 20	007-07-01
Pennsylvania Right To Know Components	
CAS-No. Re	evision Date
o-Cresol 95-48-7 20	007-07-01
New Jersey Right To Know Components	
CAS-No. Re	evision Date
o-Cresol 95-48-7 20	007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. Aquatic Acute Aquatic Chronic	Acute toxicity Acute aquatic toxicity Chronic aquatic toxicity
Eye Dam.	Serious eye damage
H301	Toxic if swallowed.
H301 + H311	Toxic if swallowed or in contact with skin
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	3
Eine I I en en de	0

Fire Hazard:	2
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.7

Revision Date: 05/27/2015

Print Date: 04/01/2016

SIGMA-ALDRICH

Material Safety Data Sheet

Version 5.0 Revision Date 11/13/2012 Print Date 03/19/2014

1. PRODUCT AND COMPANY ID	DENT	IFICATION
Product name	:	o-Xylene
Product Number Brand	:	95660 Fluka
Supplier	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency Phone # (For both supplier and manufacturer)	:	(314) 776-6555
Preparation Information	:	Sigma-Aldrich Corporation Product Safety - Americas Region 1-800-521-8956

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Flammable liquid, Harmful by skin absorption., Irritant, Reproductive hazard

Target Organs

Liver, Kidney, Nerves.

GHS Classification

Flammable liquids (Category 3) Acute toxicity, Inhalation (Category 4) Acute toxicity, Dermal (Category 4) Skin irritation (Category 2) Acute aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram



Signal word	Warning
Hazard statement(s) H226 H312 + H332 H315 H401	Flammable liquid and vapour. Harmful in contact with skin or if inhaled Causes skin irritation. Toxic to aquatic life.
Precautionary statement(s) P280	Wear protective gloves/ protective clothing.

2

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3

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HMIS Classification Health hazard: Chronic Health Hazard: Flammability: Physical hazards:

NFPA Rating	
Health hazard:	2
Fire:	3
Reactivity Hazard:	0

Potential Health Effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	Causes skin irritation.
Eyes	Causes eye irritation.
Ingestion	May be harmful if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Synonyms	: 1,2-Dimethylbenzene	
Formula Molecular Weight	: C ₈ H ₁₀ : 106.17 g/mol	
Component		Concentration
o-Xylene		
CAS-No.	95-47-6	-
EC-No.	202-422-2	
Index-No.	601-022-00-9	

4. FIRST AID MEASURES

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

5. FIREFIGHTING MEASURES

Conditions of flammability

Flammable in the presence of a source of ignition when the temperature is above the flash point. Keep away from heat/sparks/open flame/hot surface. No smoking.

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Special protective equipment for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products

Hazardous decomposition products formed under fire conditions. - Carbon oxides

Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions

Use personal protective equipment. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

7. HANDLING AND STORAGE

Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge.

Conditions for safe storage

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Components with workplace control parameters

Components	CAS-No.	Value	Control parameters	Basis
o-Xylene	95-47-6	STEL	150 ppm 655 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	100 ppm 435 mg/m3	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000
		TWA	100 ppm 434 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Remarks	Not classifial	ble as a hu	human carcinogen	
		TWA	100 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Eye & Upper there is a Bio carcinogen	Respirato	spiratory Tract irritation Central Nervous System impairment Substances for which cal Exposure Index or Indices (see BEI® section) Not classifiable as a human	
		STEL	EL 150 ppm USA. ACGIH Threshold Limit Values (TLV)	
	Eye & Upper there is a Bio carcinogen	Ipper Respiratory Tract irritation Central Nervous System impairment Substances for which a Biological Exposure Index or Indices (see BEI® section) Not classifiable as a human gen		
		TWA	TWA 100 ppm USA. Occupational Exposure Limits (OSI 435 mg/m3 Limits for Air Contaminants	
		TWA	100 ppm 435 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	150 ppm 655 mg/m3	USA. NIOSH Recommended Exposure Limits

Personal protective equipment

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multi-purpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: > 480 min Material tested:Vitoject® (Aldrich Z677698, Size M)

Splash protection Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: > 30 min Material tested:Camatril® (Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374 If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an Industrial Hygienist familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Eye protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin and body protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

	Form	liquid
	Colour	colourless
Sa	afety data	
	рН	no data available
	Melting point/freezing point	Melting point/range: -2623 °C (-159 °F) - lit.
	Boiling point	143 - 145 °C (289 - 293 °F) - lit.
	Flash point	31.0 °C (87.8 °F) - closed cup
	Ignition temperature	464 °C (867 °F)
	Autoignition temperature	464.0 °C (867.2 °F)
	Lower explosion limit	0.9 %(V)
	Upper explosion limit	6.7 %(V)
	Vapour pressure	21.3 hPa (16.0 mmHg) at 37.7 °C (99.9 °F) 8.8 hPa (6.6 mmHg) at 25.0 °C (77.0 °F)
	Density	0.879 g/mL at 20 °C (68 °F)
	Water solubility	no data available
	Partition coefficient:	log Pow: 3.12

n-octanol/water	
Relative vapour density	no data available
Odour	no data available
Odour Threshold	no data available
Evaporation rate	no data available

10. STABILITY AND REACTIVITY

Chemical stability

Stable under recommended storage conditions.

Possibility of hazardous reactions

Vapours may form explosive mixture with air.

Conditions to avoid

Heat, flames and sparks.

Materials to avoid Oxidizing agents

Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides Other decomposition products - no data available

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50 no data available

Inhalation LC50 no data available

Dermal LD50 no data available

Other information on acute toxicity LD50 Intraperitoneal - mouse - 1,364 mg/kg

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation no data available

Respiratory or skin sensitization no data available

Germ cell mutagenicity

no data available

Carcinogenicity

This product is or contains a component that is not classifiable as to its carcinogenicity based on its IARC, ACGIH, NTP, or EPA classification.

IARC: 3 - Group 3: Not classifiable as to its carcinogenicity to humans (o-Xylene)

NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a

known or anticipated carcinogen by NTP.

OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Suspected human reproductive toxicant

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System) no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System) no data available

Aspiration hazard

no data available

Potential health effects

Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Ingestion	May be harmful if swallowed.
Skin	Causes skin irritation.
Eyes	Causes eye irritation.

Signs and Symptoms of Exposure

narcosis, Lung irritation, chest pain, pulmonary edema, Central nervous system depression, Dermatitis, Gastrointestinal disturbance, Liver injury may occur., Kidney injury may occur., Blood disorders

Synergistic effects

no data available

Additional Information RTECS: ZE2450000

12. ECOLOGICAL INFORMATION

Toxicity

Toxicity to fish	LC50 - Lepomis macrochirus (Bluegill) - 16.10 mg/l - 96 h
	LC50 - Carassius auratus (goldfish) - 13.00 mg/l - 24 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 1.39 - 1.87 mg/l - 48 h
Toxicity to algae	EC50 - Pseudokirchneriella subcapitata (green algae) - 4.70 mg/l - 72 h
	EC50 - Chlorella vulgaris (Fresh water algae) - 55.00 mg/l - 24 h
	· · · · ·

Persistence and degradability

no data available

Bioaccumulative potential no data available

Mobility in soil no data available

PBT and vPvB assessment no data available

Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

	DOT (US) UN number: 1307 Class: 3 Proper shipping name: Xylenes Reportable Quantity (RQ): 100 lbs Marine pollutant: No Poison Inhalation Hazard: No	Packing group: III			
	IMDG UN number: 1307 Class: 3 Proper shipping name: XYLENES Marine pollutant: No	Packing group: III	EMS-No: F-E, S-D		
	IATA UN number: 1307 Class: 3 Proper shipping name: Xylenes	Packing group: III			
R	EGULATORY INFORMATION				
	OSHA Hazards Flammable liquid, Harmful by skin absorption	on., Irritant, Reproductive haz	ard		
	SARA 302 Components SARA 302: No chemicals in this material an	re subject to the reporting req	uirements of SARA Title II	I, Section 302.	
	SARA 313 Components The following components are subject to reporting levels established by SARA Title III, Section 313:				
	o-Xylene		CAS-No. 95-47-6	Revision Date 2007-07-01	
	SARA 311/312 Hazards Fire Hazard, Acute Health Hazard, Chronic	Health Hazard			
	Massachusetts Right To Know Compon	ents			
			CAS-No.	Revision Date	
	o-Xylene		95-47-6	2007-07-01	
	Pennsylvania Right To Know Componer	nts			
	o-Xvlene		CAS-No. 95-47-6	Revision Date	
			33-47-0	2007-07-01	
	New Jersey Right 10 Know Components	5	CAS-No.	Revision Date	
	o-Xylene		95-47-6	2007-07-01	

15.

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

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4 4

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.10 Revision Date 11/12/2015 Print Date 02/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	<i>p</i> -Cresol	
	Product Number Brand Index-No.	::	W233706 Aldrich 604-004-00-9	
	CAS-No.	:	106-44-5	

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Acute toxicity, Dermal (Category 3), H311 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s) H301 + H311 H314 H411 Precautionary statement(s) P260

Toxic if swallowed or in contact with skin Causes severe skin burns and eye damage. Toxic to aquatic life with long lasting effects.

Do not breathe dust or mist. Wash skin thoroughly after handling. Do not eat, drink or smoke when using this product.

P264

P270

P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P322	Specific measures (see supplemental first aid instructions on this label)
P361	Remove/Take off immediately all contaminated clothing.
P363	Wash contaminated clothing before reuse.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances Synonyms

s : 4-Methylphenol

:	C ₇ H ₈ O
:	108.14 g/mol
:	106-44-5
:	203-398-6
:	604-004-00-9
	: : : : : : : : : : : : : : : : : : : :

Hazardous components

Component	Classification	Concentration
p-Cresol		
	Acute Tox. 3; Skin Corr. 1B; Eye Dam. 1; Aquatic Acute 2; Aquatic Chronic 2; H301 + H311, H314, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

hygroscopic Air and light sensitive. Handle and store under inert gas.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
p-Cresol	106-44-5	TWA	2.3 ppm	USA. NIOSH Recommended
			10 mg/m3	Exposure Limits
		TWA	5 ppm 22 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	Skin designation The value in mg/m3 is approximate.		

TWA	20 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
Upper Respiratory Tract irritation Not classifiable as a human carcinogen Danger of cutaneous absorption		n n

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 30 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing	Melting point/range: 31 - 37 °C (88 - 99 °F)
	point	Melting point/range: 32 - 34 $^\circ\text{C}$ (90 - 93 $^\circ\text{F})$ - lit.
-----	--	---
f)	Initial boiling point and boiling range	202 °C (396 °F) - lit.
g)	Flash point	85.0 °C (185.0 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Lower explosion limit: 1.1 %(V)
k)	Vapour pressure	1.3 hPa (1.0 mmHg) at 20.0 °C (68.0 °F)
I)	Vapour density	No data available
m)	Relative density	1.034 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	log Pow: 1.94
p)	Auto-ignition temperature	559.0 °C (1,038.2 °F)
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	er safety information	

No data available

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Oxidizing agents, Bases
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 207.0 mg/kg Remarks: Sense Organs and Special Senses (Nose, Eye, Ear, and Taste):Olfaction:Other changes. Behavioral:Convulsions or effect on seizure threshold. Gastrointestinal:Ulceration or bleeding from stomach.

LC50 Inhalation - Rat - 1 h - > 710 mg/m3

LD50 Dermal - Rabbit - 301.0 mg/kg Remarks: Behavioral:Tremor. Gastrointestinal:Changes in structure or function of salivary glands. Kidney, Ureter, Bladder:Other changes.

No data available

Skin corrosion/irritation Skin - Rabbit

Result: Severe skin irritation - 24 h

Serious eye damage/eye irritation Eyes - Rabbit Result: Severe eye irritation

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: GO6475000

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, laryngitis, Dizziness, Cardiovascular effects., Muscle cramps/spasms., Symptoms of exposure may include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, and vomiting.

Kidney -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - other fish - 16.00 - 24.00 mg/l - 24 h
	LC50 - Oncorhynchus mykiss (rainbow trout) - 7.9 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	LC50 - Daphnia magna (Water flea) - 1.4 mg/l - 48 h

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential Does not bioaccumulate.

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

15.

UN number: 3455 Proper shipping name Reportable Quantity (I	Class: 6.1 (8) e: Cresols, solid RQ): 100 lbs	Packing group: II			
Poison Inhalation Haz	ard: No				
IMDG UN number: 3455 Proper shipping name	Class: 6.1 (8) e: CRESOLS, SOLID	Packing group: II	EMS	S-No: F-A, S-B	
IATA UN number: 3455 Proper shipping name	Class: 6.1 (8) :: Cresols, solid	Packing group: II			
REGULATORY INFORM	IATION				
SARA 302 Compone No chemicals in this r	ents material are subject to th	e reporting requirements	of SARA Ti	tle III, Section 302.	
SARA 313 Compone The following compor	ents nents are subject to repo	rting levels established by	/ SARA Titl	e III, Section 313:	
p-Cresol		106-	44-5	2007-07-01	
SARA 311/312 Hazar Acute Health Hazard	rds				
Massachusetts Righ	nt To Know Component	ts			
p-Cresol		CAS 106-	-No. 44-5	Revision Date 2007-07-01	
Pennsylvania Right	To Know Components				
p-Cresol		CAS 106-	-No. 44-5	Revision Date 2007-07-01	
New Jersey Right To	o Know Components				
p-Cresol		CAS 106-	-No. 44-5	Revision Date 2007-07-01	
California Prop. 65 0	Components				

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Dam.	Serious eye damage
H301	Toxic if swallowed.
H301 + H311	Toxic if swallowed or in contact with skin
H311	Toxic in contact with skin.
H314	Causes severe skin burns and eye damage.

HMIS Rating

Health hazard:	3	
Chronic Health Hazard:		
Flammability:	0	
Physical Hazard	0	
NFPA Rating		
NFPA Rating Health hazard:	3	
NFPA Rating Health hazard: Fire Hazard:	3 2	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.10

Revision Date: 11/12/2015

Print Date: 02/07/2016



MATERIAL SAFETY DATA SHEET

(POLYCHLORINATED BIPHENYLS)

COMPOSITION/INFORMATION ON INGREDIENTS

Ingredients Name: polychlorinated biphenyls (PCBs)

HAZARD IDENTIFICATION

Reports of Carcinogenicity: YES

HEALTH HAZARDS ACUTE AND CHRONIC

- **Eves**: Moderately irritating to eye tissues.
- <u>Skin</u>: Can be absorbed through intact skin, may cause de-fatting, potential for chloracne.
- <u>Inhalation</u>: Possible liver injury.
- **<u>Ingestion</u>**: Slightly toxic; reasonably anticipated to be carcinogenic.

EFFECTS OF OVER-EXPOSURE

Can cause dermatological symptoms; however, these are reversible upon removal of exposure source.

FIRST AID MEASURES

- <u>Eyes</u>: Irrigate immediately with copious quantities of running water for at least 15 minutes if liquid or solid PCBs get into them.
- <u>Skin</u>: Contaminated clothing should be removed and the skin washed thoroughly with soap and water. Hot PCBs may cause thermal burns.
- <u>Inhalation</u>: Remove to fresh air; if skin rash or respiratory irritation persists, consult a physician (if electrical equipment arcs over, PCBs may decompose to produce hydrochloric acid).
- <u>Ingestion</u>: Consult a physician. Do not induce vomiting or give any oily laxatives. (If large amounts are ingested, gastric lavage is suggested).

FIRE FIGHTING MEASURES: Flash Point: >141 °C (285.8 °F)

EXTINGUISHING MEDIA: PCBs are fire-resistant compounds.

FIRE-FIGHTING PROCEDURES

Standard fire-fighting wearing apparel and self-contained breathing apparatus should be worn when fighting fires that involve possible exposure to chemical combustion products. Fire fighting equipment should be thoroughly cleaned and decontaminated after use.

UNUSUAL FIRE/EXPLOSION HAZARD

If a PCB transformer is involved in a fire-related incident, the owner of the transformer is required to report the incident. Consult and follow appropriate federal, provincial and local regulations.

<u>Note</u>: When askarel liquid becomes involved in a fire, toxic by-products of combustion are typically produced including polychlorinated dibenzofurans and polychlorinated dibenzodioxins, both known carcinogens. The structures of these chemical species are as follows:



2,3,7,8-tetrachlorodibenzofuran



2,3,7,8-tetrachloro-dibenzo-p-dioxin

<u>Note</u>: 2,3,7,8-tetrachloro-dibenzo-p-dioxin is one of the most potent teratogenic, mutagenic and carcinogenic agents known to man.

SPILL RELEASE PROCEDURES

Cleanup & disposal of liquid PCBs are strictly regulated by the federal government. Ventilate area. Contain spill/leak. Remove spill by means of absorptive material. Spill clean-up personnel should use proper protective clothing. All wastes and residues containing PCBs should be collected, containerized, marked and disposed of in the manner prescribed by applicable federal, provincial and local laws.

HANDLING AND STORAGE PRECAUTIONS

Care should be taken to prevent entry into the environment through spills, leakage, use, vaporization, or disposal of liquid. Avoid prolonged breathing of vapours or mists. Avoid contact with eyes or prolonged contact with skin. Comply with all federal, provincial and local regulations.

OTHER PRECAUTIONS

Federal regulations require PCBs, PCB items, storage areas, transformer vaults, and transport vehicles to be appropriately labelled.

RESPIRATORY PROTECTION

Use OHSA approved equipment when airborne exposure limits are exceeded. Full facepiece equipment is recommended and, if used, replaces need for face shield and/or chemical splash goggles. The respirator use limitations specified by the manufacturer must be observed.

VENTILATION

Provide natural or mechanical ventilation to control exposure levels below airborne exposure levels.

PROTECTIVE GLOVES: Wear appropriate chemical resistant gloves to prevent skin contact.

EYE PROTECTION: Wear chemical splash goggles and have eye baths available.

OTHER PROTECTIVE EQUIPMENT

Wear appropriate protective clothing. Provide a safety shower at any location where skin contact can occur.

WORK HYGIENIC PRACTICES

Wash thoroughly after handling. Supplemental safety and health : none

PHYSICAL/CHEMICAL PROPERTIES

- **Vapour pressure:** (mm Hg @100 °F) 0.005 0.00006
- Viscosity: (CENTISTOKES) 3.6 540
- Stability indicator/materials to avoid: Yes
- <u>Stability Condition to Avoid</u>: PCBs are very stable, fire-resistant compounds.

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide, hydrogen chloride, phenolics, aldehydes, furans, dioxins

WASTE DISPOSAL METHODS

Consult the applicable PCB regulations prior to any disposal of PCBs or PCB-contaminated items.

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.9 Revision Date 12/29/2015 Print Date 02/22/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Pentachlorophenol
	Product Number Brand Index-No.	: : :	P2604 Aldrich 604-002-00-8
	CAS-No.	:	87-86-5
1.2	Relevant identified uses of	th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Acute toxicity, Inhalation (Category 2), H330 Acute toxicity, Dermal (Category 3), H311 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Hazard statement(s)	
H301 + H311	Toxic if swallowed or in contact with skin
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.

Danger

H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
D 004	protection.
P284	Wear respiratory protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician. Rinse mouth.
P302 + P352 + P312	IF ON SKIN: Wash with plenty of soap and water. Call a POISON
D004 + D040 + D040	CENTER of doctor/ physician if you feel unwell.
P304 + P340 + P310	breathing. Immediately call a POISON CENTER or doctor/ physician.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
P308 + P313	IF exposed or concerned: Get medical advice/ attention
$P332 \pm P313$	If skin irritation occurs: Get medical advice/ attention
$P337 \pm P313$	If eve irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse
P301	Collect spillage
$P_{103} + P_{233}$	Store in a well-ventilated place. Keep container tightly closed
P405	Store locked up
P501	Disnose of contents/ container to an approved waste disposal plant
1 001	Dispose of contents, container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₆ HCl ₅ O
Molecular weight	:	266.34 g/mol
CAS-No.	:	87-86-5
EC-No.	:	201-778-6
Index-No.	:	604-002-00-8

Hazardous components

Component	Classification	Concentration
Pentachlorophenol		
	Acute Tox. 3; Acute Tox. 2; Acute Tox. 3; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; STOT SE 3; Aquatic Acute 1; Aquatic Chronic 2; H301 + H311, H315, H319, H330, H335, H351, H400, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis		
			parameters			
Pentachlorophenol	87-86-5	TWA	0.500000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)		
	Remarks	Central Nerv	ous System impair	rment		
		Upper Respiratory Tract irritation				
		Eve irritation				
		Cardiac impa	airment			
		Adopted value	ues or notations en	closed are those for which changes		
		are proposed	d in the NIC			
		See Notice of	of Intended Change	es (NIC)		
		Substances	for which there is a	Biological Exposure Index or Indices		
		(see BEI® se	ection)			
		Confirmed a	nimal carcinogen v	vith unknown relevance to humans		
		Danger of cu	utaneous absorptio	n		
		TWA	0.500000	USA. NIOSH Recommended		
			mg/m3	Exposure Limits		
		Potential for	dermal absorption			
		TWA	0.500000	USA. Occupational Exposure Limits		
			mg/m3	(OSHA) - Table Z-1 Limits for Air		
				Contaminants		
		Skin designa	Skin designation			
		TWA	0.5 mg/m3	USA. ACGIH Threshold Limit Values (TLV)		
		Central Nerv	ous System impair	ment		
		Upper Respiratory Tract irritation				
		Eye irritation	1			
		Cardiac impa	airment			
		2015 Adoption	on			
		Substances	for which there is a	a Biological Exposure Index or Indices		
		(see BEI® section)				
		Confirmed a	nimal carcinogen v	vith unknown relevance to humans		
		Danger of cu	itaneous absorptio	n		
		STEL	1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)		
		Central Nerv	ous System impair	ment		
		Upper Respi	iratory Tract irritatio	n		
		Eye irritation				
		Cardiac impa	airment			
		2015 Adoption	on			
		Substances	for which there is a	a Biological Exposure Index or Indices		
		(see BEI® section)				
		Confirmed animal carcinogen with unknown relevance to humans				
		Danger of cu	utaneous absorptio	n		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis	
Pentachlorophenol	87-86-5	pentachlorop henol	2.0000 mg/g	Urine	ACGIH - Biological Exposure Indices (BEI)	
	Remarks	Prior to last shift of workweek				
		Free PCP	5.0000 mg/l	In plasma	ACGIH - Biological Exposure Indices (BEI)	
		End of shift (As soon as possible after exposure ceases)				
		pentachlorop henol		Urine	ACGIH - Biological Exposure Indices (BEI)	

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact Material: Fluorinated rubber

Minimum layer thickness: 0.7 mm Break through time: 120 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: light red
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 165 - 180 °C (329 - 356 °F)
f)	Initial boiling point and boiling range	310 °C (590 °F)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower	No data available

flammability or explosive limits

- k) Vapour pressure 53.3 hPa (40.0 mmHg) at 211.2 °C (412.2 °F)
- I) Vapour density No data available
- m) Relative density 1.978 g/mL at 25 °C (77 °F)
- n) Water solubility No data available
- Partition coefficient: n- log Pow: 5.12 octanol/water
- p) Auto-ignition No data available temperature
- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available

9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents, Strong bases
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 27 mg/kg Remarks: Vascular:BP elevation not charactertized in autonomic section. Endocrine:Hyperglycemia. Nutritional and Gross Metabolic:Changes in:Body temperature increase.

LC50 Inhalation - Rat - 355 mg/m3 Remarks: Behavioral:Excitement. Behavioral:Muscle contraction or spasticity. Lungs, Thorax, or Respiration:Dyspnea.

LD50 Dermal - Rat - 96.0 mg/kg Remarks: Behavioral:Excitement. Behavioral:Muscle contraction or spasticity. Lungs, Thorax, or Respiration:Dyspnea.

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Open irritation test - 24.00 h

Serious eye damage/eye irritation

Eyes - Rabbit Result: Mild eye irritation - 24.00 h

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

The evidence for carcinogenicity of pentachlorophenol (PCP) is based on assays that utilized less than pure PCP. Contaminants of PCP include: tri- or tetra- chlorophenol, hexachlorobenzene, polychlorinated dibenzo-p-dioxins, or polychlorinated dibenzofurans. Indications are that positive evidence for carcinogenicity is from the contaminant(s) and not the PCP. This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

Limited evidence of carcinogenicity in animal studies

- IARC: 2B Group 2B: Possibly carcinogenic to humans (Pentachlorophenol)
- NTP: Reasonably anticipated to be a human carcinogen (Pentachlorophenol)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Specific target organ toxicity - single exposure May cause respiratory irritation.

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: Not available

Convulsions

Kidney -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish LC50 - Cyprinodon variegatus (sheepshead minnow) - 0.16 - 0.5 mg/l - 96.0			
	LC50 - Carassius auratus (goldfish) - 0.16 - 0.38 mg/l - 96.0 h		
	LC50 - Oncorhynchus mykiss (rainbow trout) - 0.075 mg/l - 96.0 h		
	NOEC - other fish - 0.01 mg/l - 24.0 h		
	LOEC - other fish - 0.1 mg/l - 24.0 h		
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 0.30 - 1.30 mg/l - 48 h		
Toxicity to algae	EC50 - No information available 0.36 mg/l - 10 d		
	EC50 - Chlorella vulgaris (Fresh water algae) - 10.30 mg/l - 96 h		
	Growth inhibition EC50 - Scenedesmus quadricauda (Green algae) - 0.08 mg/l - 96 h		

12.2 Persistence and degradability Biodegradability

Result: 99 % - Biodegradable

Bioaccumulative potential 12.3 Bioaccumulation

Oncorhynchus mykiss (rainbow trout) - 144 h - 0.0912 ma/l

Bioconcentration factor (BCF): 482

12.4 Mobility in soil

No data available

Results of PBT and vPvB assessment 12.5 PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of upprofessional handling or disposal. Very toxic to aquatic life with long lasting effects.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3155 Class: 6.1 Packing group: II Proper shipping name: Pentachlorophenol Reportable Quantity (RQ): 10 lbs Poison Inhalation Hazard: No IMDG UN number: 3155 Class: 6.1 Packing group: II EMS-No: F-A, S-A Proper shipping name: PENTACHLOROPHENOL Marine pollutant: yes ΙΑΤΑ UN number: 3155 Class: 6.1 Packing group: II Proper shipping name: Pentachlorophenol

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Pentachlorophenol	87-86-5	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Pentachlorophenol	87-86-5	2007-07-01

New Jersey Right To Know Components		
	CAS-No.	Revision Date
Pentachlorophenol	87-86-5	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Pentachlorophenol	87-86-5	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
H301	Toxic if swallowed.
H301 + H311	Toxic if swallowed or in contact with skin
H311	Toxic in contact with skin.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H330	Fatal if inhaled.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	1

NFPA Rating

Health hazard:	4
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.9

Revision Date: 12/29/2015

Print Date: 02/22/2016

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.5 Revision Date 07/08/2014 Print Date 02/09/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	4-Ethyltoluene
	Product Number Brand	:	E49800 Aldrich
	CAS-No.	:	622-96-8
1.2 Relevant identified uses of the substance or mixture a		e substance or mixture and uses advised against	
	Identified uses	:	Laboratory chemicals, Manufacture of substances
1.3	Details of the supplier of t	he s	safety data sheet
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052
4 4	Emorgonov tolonhono nur	nha	-

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226 Aspiration hazard (Category 1), H304

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/

P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P331	Do NOT induce vomiting.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₉ H ₁₂
Molecular Weight	:	120.19 g/mol
CAS-No.	:	622-96-8
EC-No.	:	210-761-2

Hazardous components

Component	Classification	Concentration
4-Ethyltoluene		
	Flam. Liq. 3; Asp. Tox. 1;	-
	H226, H304	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed no data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self contained breathing apparatus for fire fighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact

Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: clear, liquid Colour: light yellow
b)	Odour	no data available
c)	Odour Threshold	no data available
d)	рН	no data available
e)	Melting point/freezing point	no data available
f)	Initial boiling point and boiling range	162 °C (324 °F) - lit.
g)	Flash point	43 °C (109 °F) - closed cup
h)	Evapouration rate	no data available
i)	Flammability (solid, gas)	no data available
j)	Upper/lower flammability or explosive limits	no data available
k)	Vapour pressure	no data available
I)	Vapour density	no data available
m)	Relative density	0.861 g/cm3 at 25 °C (77 °F)
n)	Water solubility	no data available
o)	Partition coefficient: n- octanol/water	no data available
p)	Auto-ignition temperature	no data available
q)	Decomposition temperature	no data available
r)	Viscosity	no data available
s)	Explosive properties	no data available

t) Oxidizing properties no data available

9.2 Other safety information no data available

10. STABILITY AND REACTIVITY

10.1 Reactivity

no data available

10.2 Chemical stability Stable under recommended storage conditions.

- **10.3** Possibility of hazardous reactions no data available
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5** Incompatible materials Oxidizing agents

10.6 Hazardous decomposition products Other decomposition products - no data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - rat - 4,850 mg/kg Remarks: Behavioral:Convulsions or effect on seizure threshold. Behavioral:Ataxia.

Inhalation: no data available

Dermal: no data available

no data available

Skin corrosion/irritation

no data available

Serious eye damage/eye irritation

no data available

Respiratory or skin sensitisation

no data available

Germ cell mutagenicity

mouse Sister chromatid exchange

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

no data available

Reproductive toxicity - rat - Oral

Maternal Effects: Other effects. Effects on Fertility: Post-implantation mortality (e.g., dead and/or resorbed implants per total number of implants).

no data available

Specific target organ toxicity - single exposure no data available

Specific target organ toxicity - repeated exposure no data available

Aspiration hazard

The substance or mixture is known to cause human aspiration toxicity hazards or has to be regarded as if it causes a human aspiration toxicity hazard.

Additional Information

RTECS: XT2550000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

- 12.1 Toxicity no data available
- 12.2 Persistence and degradability no data available
- **12.3 Bioaccumulative potential** no data available
- **12.4 Mobility in soil** no data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

no data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3295 Class: 3 Packing group: III Proper shipping name: Hydrocarbons, liquid, n.o.s. Marine pollutant: No Poison Inhalation Hazard: No

IMDG

UN number: 3295 Class: 3 Packing group: III EMS-No: F-E, S-D Proper shipping name: HYDROCARBONS, LIQUID, N.O.S. Marine pollutant: No

IATA

15. REGULATORY INFORMATION

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

4-Ethyltoluene	CAS-No. 622-96-8	Revision Date
New Jersey Right To Know Components		
	CAS-No.	Revision Date
4-Ethyltoluene	622-96-8	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Asp. Tox.	Aspiration hazard
Flam. Liq.	Flammable liquids
H226	Flammable liquid and vapour.
H304	May be fatal if swallowed and enters airways.

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	
Flammability:	2
Physical Hazard	0

NFPA Rating

Health hazard:	0	
Fire Hazard:	2	
Reactivity Hazard:	0	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956



SAFETY DATA SHEET

Version 6.4 Revision Date 04/18/2021 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

1.2	Relevant identified up	ses	of the substance or mixture and uses advised against
	CAS-No.	:	335-67-1
	Brand	:	Aldrich
	Product Number	:	171468
	Product name	:	Perfluorooctanoic acid

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 6310 UNITED STATES	3
Telephone Fax	: +1 314 771-5765 : +1 800 325-5052	

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 1B), H360 Effects on or via lactation, H362 Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Aldrich - 171468

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The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada



Signal word	Danger
Hazard statement(s) H302 H314 H351 H360 H362 H372	Harmful if swallowed. Causes severe skin burns and eye damage. Suspected of causing cancer. May damage fertility or the unborn child. May cause harm to breast-fed children. Causes damage to organs (Liver) through prolonged or repeated exposure.
Precautionary statement(s)	
P201 P202	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 +	IF IN EYES: Rinse cautiously with water for several minutes.
P310	Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

.1	Substances Synonyms Formula	:	Pentadecafluoroocta Perfluorocaprylic ac Perfluorooctanoic ac C8HF15O2	anoic acid id cid	
	Molecular weight	:	414.07 g/mol		
	CAS-No.	:	335-67-1		
	EC-No.	:	206-397-9		
	Component			Classification	Concentration
	pentadecafluorooc	anoi	c acid		
				Acute Tox. 4; Skin Corr.	<= 100 %

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The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada



1B; Eye Dam. 1; Carc. 2;	
Repr. 1B; Lact. ; STOT RE	
1; H302, H314, H318,	
H351, H360, H362, H372	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides Hydrogen fluoride Combustible. Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

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5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures** Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.
- **6.2 Environmental precautions** Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

Aldrich - 171468

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8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: > 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: > 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Acid-resistant protective clothing

Respiratory protection

required when dusts are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance Form: flakes Color: colorless

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b)	Odor	stinging			
c)	Odor Threshold	No data available			
d)	рН	2.6 at 1 g/l at 20 °C (68 °F)			
e)	Melting point/freezing point	Melting point/range: 55 - 56 °C (131 - 133 °F) - lit.			
f)	Initial boiling point and boiling range	189 °C 372 °F at 981 hPa - lit.			
g)	Flash point	No data available			
h)	Evaporation rate	No data available			
i)	Flammability (solid, gas)	No data available			
j)	Upper/lower flammability or explosive limits	No data available			
k)	Vapor pressure	0.69 hPa at 25 °C (77 °F)			
I)	Vapor density	No data available			
m)	Relative density	No data available			
n)	Water solubility	3.4 g/l at 20 °C (68 °F)			
o)	Partition coefficient: n-octanol/water	log Pow: 6.30 - Potential bioaccumulation, (Lit.)			
p)	Autoignition temperature	No data available			
q)	Decomposition temperature	> 300 °C (> 572 °F) -			
r)	Viscosity	No data available			
s)	Explosive properties	No data available			
t)	Oxidizing properties	No data available			
Oth	Other safety information				

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with: Strong oxidizing agents Strong acids Bases

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10.4 Conditions to avoid no information available

- **10.5 Incompatible materials** No data available
- **10.6 Hazardous decomposition products** In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity Acute toxicity estimate Oral - 500.1 mg/kg

(Expert judgment)

Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l (Expert judgment)

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Germ cell mutagenicity

No data available

No data available No data available

Carcinogenicity

Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (pentadecafluorooctanoic acid)

- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

May damage the unborn child. Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure

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Specific target organ toxicity - repeated exposure Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard

11.2 Additional Information

RTECS: RH0781000

Cough, Shortness of breath, Headache, Nausea, Vomiting To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain Nausea Vomiting Drowsiness somnolence

Handle in accordance with good industrial hygiene and safety practice.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (pentadecafluorooctanoic acid)
Toxicity to algae	Remarks: No data available (pentadecafluorooctanoic acid)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Discharge into the environment must be avoided.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

UN number: 3261 Class: 8 Packing group: III Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid) Reportable Quantity (RQ): Poison Inhalation Hazard: No

IMDG

UN number: 3261 Class: 8 Packing group: III EMS-No: F-A, S-B Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (pentadecafluorooctanoic acid)

ΙΑΤΑ

UN number: 3261 Class: 8 Packing group: III Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

pentadecafluorooctanoic acid	CAS-No.	Revision Date
	335-67-1	2018-02-01

New Jersey Right To Know Components

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SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.4

Revision Date: 04/18/2021

Print Date: 06/19/2021

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SAFETY DATA SHEET

Version 4.2 Revision Date 09/08/2015 Print Date 10/19/2018

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Nonafluorobutane-1-sulfonic acid
	Product Number Brand	:	562629 Aldrich
	CAS-No.	:	375-73-5
1.2	Relevant identified uses	s of th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances
1.3	Details of the supplier o	of the :	safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

LINEIGENCY FILINE #	Emergency Phone #	:	+1-703-527-3887	(CHEMTREC
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2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS) Acute toxicity, Oral (Category 4), H302 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s) H302 H314	Harmful if swallowed. Causes severe skin burns and eye damage.
Precautionary statement(s) P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
P301 + P330 + P331 P303 + P361 + P353	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting. IF ON SKIN (or hair): Remove/ Take off immediately all contaminated

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	clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER or doctor/ physician.
P321	Specific treatment (see supplemental first aid instructions on this label).
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS Reacts violently with water.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	C ₄ HF ₉ O ₃ S
Molecular weight	:	300.10 g/mol
CAS-No.	:	375-73-5
EC-No.	:	206-793-1

Hazardous components

Component	Classification	Concentration	
1,1,2,2,3,3,4,4,4-Nonafluorobutane-1-sulphonic acid			
	Acute Tox. 4; Skin Corr. 1B;	<= 100 %	
	Eye Dam. 1; H302, H314		
For the full text of the H-Statements mentioned in this Section, see Section 16.			

4. FIRST AID MEASURES

4.1 **Description of first aid measures**

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

Indication of any immediate medical attention and special treatment needed 4.3 No data available

5. FIREFIGHTING MEASURES

5.1 **Extinguishing media**

- Suitable extinguishing media Dry powder
- 5.2 Special hazards arising from the substance or mixture Carbon oxides, Sulphur oxides, Hydrogen fluoride
5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. For personal protection see section 8.

6.2 Environmental precautions Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Soak up with inert absorbent material and dispose of as hazardous waste. Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage. Never allow product to get in contact with water during storage.

Recommended storage temperature 2 - 8 °C

Handle and store under inert gas.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Tightly fitting safety goggles. Faceshield (8-inch minimum). Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	112 - 114 °C (234 - 237 °F) at 19 hPa (14 mmHg) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	1.811 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

10.2 Chemical stability Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions Reacts violently with water.

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9.2

10.4 Conditions to avoid

Do not allow water to enter container because of violent reaction. Exposure to moisture

10.5 Incompatible materials Strong oxidizing agentsStrong oxidizing agents

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 430 mg/kg

Remarks: Behavioral:Somnolence (general depressed activity). Skin and Appendages: Other: Hair. Nutritional and Gross Metabolic:Weight loss or decreased weight gain.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: EK5930000

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea

12. ECOLOGICAL INFORMATION

- 12.1 Toxicity No data available
- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available
- **12.5 Results of PBT and vPvB assessment** PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3265 Class: 8 Packing group: Il Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (1,1,2,2,3,3,4,4,4-Nonafluorobutane-1-sulphonic acid)

Poison Inhalation Hazard: No

IMDG

UN number: 3265 Class: 8 Packing group: II EMS-No: F-A, S-B Proper shipping name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (1,1,2,2,3,3,4,4,4-Nonafluorobutane-1sulphonic acid)

ΙΑΤΑ

UN number: 3265 Class: 8 Packing group: Il Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (1,1,2,2,3,3,4,4,4-Nonafluorobutane-1-sulphonic acid)

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

CAS-No.

1,1,2,2,3,3,4,4,4-Nonafluorobutane-1-sulphonic acid	CAS-No. 375-73-5	Revision Date
New Jersey Right To Know Components		
1,1,2,2,3,3,4,4,4-Nonafluorobutane-1-sulphonic acid	375-73-5	

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity		
Eye Dam.	Serious eye damage		
H302	Harmful if swallowed.		
H314	Causes severe skin burns and eye damage.		
H318	Causes serious eye damage.		
Skin Corr.	Skin corrosion		
HMIS Rating			
Health hazard:	3		
Chronic Health Haza	ard:		
Flammability:	0		
Physical Hazard	0		
NFPA Rating			
Health hazard:	3		
Fire Hazard:	0		
Reactivity Hazard:	0		

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.2

Revision Date: 09/08/2015

Print Date: 10/19/2018



SAFETY DATA SHEET

Version 6.2 Revision Date 09/18/2019 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

1.2	Relevant identified us	es	of the substance or mixture and uses advised against		
	CAS-No.	:	335-76-2		
	Brand	:	Aldrich		
	Product Number	:	177741		
	Product name		Perfluorodecanoic acid		

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	: +1 314 771-5765

Fax	:	+1 800 325-5052
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1.4 Emergency telephone number

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 3), H301 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 1B), H360 Effects on or via lactation, H362

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

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Hazard statement(s)	
H301	Toxic if swallowed.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust or mist.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P310 + P330	IF SWALLOWED: Immediately call a POISON CENTER/doctor. Rinse mouth.
P308 + P313 P405	IF exposed or concerned: Get medical advice/ attention. Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1	Substances Synonyms	:	Nonadecafluorode Nonadecafluoroca Perfluorodecanoic Perfluorocapric ac	canoic acid pric acid acid id	
	Formula Molecular weight CAS-No. EC-No.	:	C ₁₀ HF ₁₉ O ₂ 514.08 g/mol 335-76-2 206-400-3		
	Component			Classification	Concentration
	Nonadecafluorodecanoic acid				
				Acute Tox. 3; Carc. 2; Repr. 1B; Lact. ; H301, H351, H360, H362	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

- **5.2 Special hazards arising from the substance or mixture** Carbon oxides, Hydrogen fluoride
- **5.3 Advice for firefighters** Wear self-contained breathing apparatus for firefighting if necessary.
- 5.4 Further information No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures Wear respiratory protection. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

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6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols.Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Keep in a dry place.

Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min

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Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a fullface particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder Colour: white
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 77 - 81 °C (171 - 178 °F) - lit.
f)	Initial boiling point and boiling range	218 °C 424 °F at 987 hPa - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available

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- k) Vapour pressure No data available
- I) Vapour density No data available
- m) Relative density No data available
- n) Water solubility No data available
- o) Partition coefficient: No data available n-octanol/water
- p) Auto-ignition No data available temperature
- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available

9.2 Other safety information No data available

SECTION 10: Stability and reactivity

10.1 Reactivity No data available

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5 Incompatible materials** Bases, Strong oxidizing agents, Reducing agents
- 10.6 Hazardous decomposition products Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen fluoride Other decomposition products - No data available In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 57 mg/kg Remarks: Behavioral:Food intake (animal). Dermal: No data available No data available

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Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity

Rat DNA damage

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information

RTECS: HD9900000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

SECTION 12: Ecological information

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber. Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

DOT (US)

UN number: 2811 Class: 6.1 Packing group: III Proper shipping name: Toxic solids, organic, n.o.s. (Nonadecafluorodecanoic acid) Reportable Quantity (RQ): Poison Inhalation Hazard: No

IMDG

UN number: 2811 Class: 6.1 Packing group: III EMS-No: F-A, S-A Proper shipping name: TOXIC SOLID, ORGANIC, N.O.S. (Nonadecafluorodecanoic acid)

ΙΑΤΑ

UN number: 2811 Class: 6.1 Packing group: III Proper shipping name: Toxic solid, organic, n.o.s. (Nonadecafluorodecanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Nonadecafluorodecanoic acid	CAS-No.
	335-76-2

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The life science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the US and Canada



Revision Date

SECTION 16: Other information

Further information

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Version: 6.2

Revision Date: 09/18/2019

Print Date: 06/19/2021

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SAFETY DATA SHEET

Version 6.3 Revision Date 04/18/2021 Print Date 07/08/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

	Product name	:	Tricosafluorododecanoic acid	
	Product Number Brand CAS-No.	::	406449 Aldrich 307-55-1	
1.2	Relevant identified us	es	of the substance or mixture and uses advised against	
	Identified uses	:	Laboratory chemicals, Synthesis of substances	

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	:	+1 314 771-5765
Fax	:	+1 800 325-5052
Emorgonov tolonhono		

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Short-term (acute) aquatic hazard (Category 1), H400

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word

Warning

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Hazard statement(s)	
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H400	Very toxic to aquatic life.
Precautionary statement(s)	
P261	Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray.
P264	Wash skin thoroughly after handling.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ eye protection/ face protection.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes.
	Remove contact lenses, if present and easy to do. Continue rinsing.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P391	Collect spillage.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms	:	Perfluorododecanoi Perfluorolauric acid	c acid	
Formula Molecular weight CAS-No. EC-No.	::	C ₁₂ HF ₂₃ O ₂ 614.10 g/mol 307-55-1 206-203-2		
Component			Classification	Concentration
Tricosafluorododec	anoic	acid		
			Acute Tox. 4; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; H302, H332, H351, H360, H362, H372 M-Factor - Aquatic Acute:	<= 100 %

10

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Consult a physician. Show this material safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

- **5.2** Special hazards arising from the substance or mixture Carbon oxides Hydrogen fluoride
- **5.3 Advice for firefighters** Wear self-contained breathing apparatus for firefighting if necessary.
- 5.4 Further information No data available

SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures** Use personal protective equipment. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.
- **6.2 Environmental precautions** Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

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6.3 Methods and materials for containment and cleaning up

Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Advice on safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Advice on protection against fire and explosion

Provide appropriate exhaust ventilation at places where dust is formed.

Hygiene measures

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): 11: Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact

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with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Impervious clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

For nuisance exposures use type P95 (US) or type P1 (EU EN 143) particle respirator.For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

	a)	Appearance	Form: crystalline Color: white
	b)	Odor	No data available
	c)	Odor Threshold	No data available
	d)	рН	No data available
	e)	Melting point/freezing point	Melting point/range: 105 - 108 °C (221 - 226 °F) - lit.
	f)	Initial boiling point and boiling range	245 °C 473 °F at 987 hPa - lit.
	g)	Flash point	()No data available
	h)	Evaporation rate	No data available
	i)	Flammability (solid, gas)	No data available
	j)	Upper/lower flammability or explosive limits	No data available
	k)	Vapor pressure	No data available
	I)	Vapor density	No data available
	m)	Relative density	No data available
	n)	Water solubility	No data available
	o)	Partition coefficient: n-octanol/water	No data available
	p)	Autoignition temperature	No data available
	q)	Decomposition temperature	No data available
	r)	Viscosity	No data available
Aldrich	- 406	5449	

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- s) Explosive properties No data available
- t) Oxidizing properties No data available
- **9.2 Other safety information** No data available

SECTION 10: Stability and reactivity

10.1 Reactivity No data available

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5 Incompatible materials** Strong oxidizing agents
- **10.6 Hazardous decomposition products** In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute toxicity estimate Oral - 500.1 mg/kg (Expert judgment)

Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l (Expert judgment)

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Germ cell mutagenicity

No data available

No data available No data available

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Carcinogenicity

Suspected of causing cancer.

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

May damage the unborn child. Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure

Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard

11.2 Additional Information

Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain Nausea Vomiting Drowsiness somnolence

Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

.. . .

12.1 Toxicity

No data available	
Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (Tricosafluorododecanoic acid)
Toxicity to algae	Remarks: No data available (Tricosafluorododecanoic acid)

12.2 Persistence and degradability

No data available

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12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

Very toxic to aquatic life.

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

ΙΑΤΑ

Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

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Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components Tricosafluorododecanoic acid	CAS-No. 307-55-1	Revision Date
Tricosafluorododecanoic acid	CAS-No. 307-55-1	Revision Date
New Jersey Right To Know Components Tricosafluorododecanoic acid	CAS-No. 307-55-1	Revision Date

SECTION 16: Other information

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.3

Revision Date: 04/18/2021

Print Date: 07/08/2021

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SAFETY DATA SHEET

Version 6.1 Revision Date 01/15/2020 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

1.2	Relevant identified u	ses	of the substance or mixture and uses advised against
	CAS-No.	:	375-85-9
	Brand	:	Aldrich
	Product Number	:	342041
	Product name	:	Perfluoroheptanoic acid

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	: +1 314 771-5765
Fax	: +1 800 325-5052

1.4 Emergency telephone number

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s) H302

Harmful if swallowed.

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H314	Causes severe skin burns and eye damage.
Precautionary statement(s)	
P260	Do not breathe dust or mist.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312	IF SWALLOWED: Call a POISON CENTER/doctor if you feel unwell.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P310	Immediately call a POISON CENTER/doctor.
P321	Specific treatment (see supplemental first aid instructions on this label).
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Component	Classification	Concentration
Perfluoroheptanoic acid		
	Acute Tox. 4; Skin Corr. 1B; Eye Dam. 1; H302, H314, H318	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

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If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.Continue rinsing eyes during transport to hospital.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2 Most important symptoms and effects, both acute and delayed** The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen fluoride Carbon oxides, Hydrogen fluoride

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

- **6.2 Environmental precautions** Do not let product enter drains.
- **6.3 Methods and materials for containment and cleaning up** Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.
- **6.4** Reference to other sections For disposal see section 13.

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SECTION 7: Handling and storage

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): 8B: Non-combustible, corrosive hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a fullface particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Do not let product enter drains.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: beige
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/freezing point: 30 °C (86 °F)
f)	Initial boiling point and boiling range	175 °C 347 °F at 989 hPa
g)	Flash point	> 113.00 °C (> 235.40 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	1.792 g/mL at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safety informatio	n

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

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10.3 Possibility of hazardous reactions No data available

- **10.4 Conditions to avoid** No data available
- **10.5 Incompatible materials** Strong oxidizing agents

10.6 Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen fluoride Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen fluoride Other decomposition products - No data available In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

No data available Inhalation: No data available Dermal: No data available No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available No data available

Specific target organ toxicity - single exposure

No data available

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Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: Not available

SECTION 12: Ecological information

- **12.1 Toxicity** No data available
- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available
- **12.5 Results of PBT and vPvB assessment** PBT/vPvB assessment not available as chemical safety assessment not required/not conducted
- 12.6 Other adverse effects

No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

DOT (US)

UN number: 3261 Class: 8 Packing group: II Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (Perfluoroheptanoic acid) Poison Inhalation Hazard: No

IMDG

UN number: 3261 Class: 8

Packing group: II

EMS-No: F-A, S-B

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Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (Perfluoroheptanoic acid)

ΙΑΤΑ

UN number: 3261 Class: 8 Packing group: II Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (Perfluoroheptanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Revision Date

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

SECTION 16: Other information

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the

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D 1

information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

 Version: 6.1
 Revision Date: 01/15/2020
 Print Date: 06/19/2021

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Safety Data Sheet 616432T according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations Date of issue: 09/21/2016 Version: 1.0

SECTION 1: Identification			
1.1. Identification			
Product form	: Substance		
Substance name	: Perfluorohexanesulfonic acid		
CAS No	: 355-46-4		
Product code	: 6164-3-2T		
Formula	: C6HF13O3S		
Synonyms	: 1,1,2,2,3,3,4,4,5,5,6,6,6-Tridecaflu	orohexane-1-sulfonic acid	
Other means of identification	: MFCD00042453		
1.2. Relevant identified uses of the substa	nce or mixture and uses advised	against	
Use of the substance/mixture	: Laboratory chemicals Manufacture of substances Scientific research and developme	nt	
1.3. Details of the supplier of the safety data	ata sheet		
SynQuest Laboratories, Inc.			
P.O. Box 309 Alachua, FL 32615 - United States of America T (386) 462-0788 - F (386) 462-7097 info@synguestlabs.com - www.synguestlabs.com			
1.4. Emergency telephone number			
Emergency number	: (844) 523-4086 (3E Company - Ac	count 10069)	
SECTION 2: Hazard(s) identification			
2.1. Classification of the substance or mi	cture		
Classification (GHS-US)			
Acute Tox 4 (Oral) H302 - Harmful if swallowe	d		
Skin Corr. 1B Eye Dam. 1 STOT SE 3 H314 - Causes severe skir H318 - Causes serious eye H335 - May cause respirat	burns and eye damage damage ory irritation		
Full text of H-phrases: see section 16			
2.2. Label elements			
GHS-US labeling			
Hazard pictograms (GHS-US)			
Signal word (GHS-US)	: Danger		
Hazard statements (GHS-US)	: H302 - Harmful if swallowed H314 - Causes severe skin burns : H335 - May cause respiratory irrita	and eye damage ttion	
Precautionary statements (GHS-US)	P260 - Do not breathe dust, mist, s P264 - Wash skin thoroughly after P270 - Do not eat, drink or smoke P271 - Use only outdoors or in a w P280 - Wear protective gloves/pro P301+P312 - If swallowed: Call a I P301+P330+P331 - If swallowed: P P303+P361+P353 - If on skin (or f skin with water/shower P304+P340 - If inhaled: Remove p P305+P351+P338 - If in eyes: Rin lenses, if present and easy to do. 0 P310 - Immediately call a POISON P321 - Specific treatment (see sup P330 - Rinse mouth	spray handling when using this product rell-ventilated area tective clothing/eye protection/face protection POISON CENTER or doctor/ physician if you f rinse mouth. Do NOT induce vomiting hair): Take off immediately all contaminated clo person to fresh air and keep comfortable for br se cautiously with water for several minutes. F Continue rinsing I CENTER or doctor/ physician oplemental first aid instructions on this label)	eel unwell othing. Rinse eathing Remove contact
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Safety Data Sheet according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

P363 - Wash contaminated clothing before reuse

P403+P233 - Store in a well-ventilated place. Keep container tightly closed P405 - Store locked up

P501 - Dispose of contents/container to an approved waste disposal plant

2.3. Other hazards				
No additional information available				
2.4. Unknown acute toxicity (GHS US	5)			
Not applicable				
SECTION 3: Composition/informa	tion on i	aredients		
3.1. Substance				
Substance type	: Mon	o-constituent		
Namo		Product identifier	0/_	Classification (GHS-US)
Perfluorohexanesulfonic acid		(CAS No) 355-46-4	70	Acute Tox, 4 (Oral), H302
(Main constituent)				Skin Corr. 1B, H314 Eye Dam. 1, H318 STOT SE 3, H335
Full text of H-phrases: see section 16		1	•	
3.2. Mixture				
Not applicable				
SECTION 4: First aid measures				
4.1. Description of first aid measures	5			
First-aid measures general	: In ca whe	se of accident or if you feel unwell, seek e possible). Move the affected personne	medical advice away from the	immediately (show the label contaminated area.
First-aid measures after inhalation	: Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. Get immediate medical advice/attention.			
First-aid measures after skin contact	 Wash with plenty of soap and water. Remove contaminated clothing and shoes. Get immediate medical advice/attention. 			
First-aid measures after eye contact	: Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.			
First-aid measures after ingestion	 Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention. 			
4.2. Most important symptoms and e	ffects, both	acute and delayed		
Symptoms/injuries	: The	most important known symptoms and ef	fects are describ	bed in the labelling (see section
ymptoms/injuries after inhalation : Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.				
4.2 Indication of any immediate more	lical attenti	and special treatment needed		
Treat symptomatically		and special treatment needed		
SECTION 5: Firefighting measure	S			
5.1. Extinguishing media				
Suitable extinguishing media	: Alco appr	hol resistant foam. Carbon dioxide. Dry p opriate for surrounding fire.	oowder. Water s	pray. Use extinguishing media
5.2. Special hazards arising from the	substance	or mixture		
Fire hazard	: The	mal decomposition generates: Carbon o	xides. Hydroger	n fluoride. Sulfur oxides.
5.3. Advice for firefighters				
Firefighting instructions	: In ca	se of fire: Evacuate area.		
Protection during firefighting	: Wear gas tight chemically protective clothing in combination with self contained breathing			
	appa	ratus. For further information refer to see	ction 8: "Exposu	re controls/personal protection".
SECTION 6: Accidental release m	easures			
6.1. Personal precautions, protective	equipment	and emergency procedures		
General measures	: Eva	uate unnecessary personnel. Ensure ad	equate air venti	lation. Do not breathe dust.
644 E				
Emergency procedures	: Only	qualified personnel equipped with suital	ole protective eq	uipment may intervene.

Protective equipment

Safety Data Sheet according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

6.1.2. For emergency responders

: Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

6.2. **Environmental precautions**

Avoid release to the environment. Notify authorities if product enters sewers or public waters.

6.3.	i.3. Methods and material for containment and cleaning up				
For conta	ainment	: Stop leak if safe to do so.			
Methods	for cleaning up	: Sweep or shovel spills into appropriate container for disposal. Minimize generation of dust.			
Other inf	ormation	: For disposal of solid materials or residues refer to section 13 : "Disposal considerations".			
6.4.	Reference to other sections				
No addit	ional information available				
SECTI	ON 7: Handling and storage				
7.1.	Precautions for safe handling				
Precautio	ons for safe handling	: Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe dust, mist, spray. Wear personal protective equipment. Avoid contact with skin and eyes.			
Hygiene measures :		: Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.			
7.2.	Conditions for safe storage, including	g any incompatibilities			
Technica	al measures	: Comply with applicable regulations.			
Storage	conditions	: Keep container closed when not in use. Hygroscopic. Keep contents under inert gas.			

. Refer to Section 10 on incompatible Materia	:	Refer to Section	10 on Incom	patible Material
---	---	------------------	-------------	------------------

: Store in dry, cool, well-ventilated area.

SECTION 8: Exposure controls/personal protection

8.1. **Control parameters**

Incompatible materials

Storage area

No additional information available

8.2. Exposure controls	
Appropriate engineering controls	: Ensure good ventilation of the work station. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.
Hand protection	: Protective gloves. 29 CFR 1910.138: Hand Protection.
Eye protection	: Chemical goggles or safety glasses. Face shield. 29 CFR 1910.133: Eye and Face Protection.
Skin and body protection	: Wear suitable protective clothing.
Respiratory protection	: In case of inadequate ventilation wear respiratory protection. 29 CFR 1910.134: Respiratory Protection.
Other information	: Safety shoes. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and	chemical properties
Physical state	: Solid
Color	: No data available
Odor	: No data available
Odor threshold	: No data available
pH	: No data available
Melting point	: No data available
Freezing point	: No data available
Boiling point	: No data available
Flash point	: No data available
Relative evaporation rate (butyl acetate=1)	: No data available
Flammability (solid, gas)	: No data available
Explosion limits	: No data available
Explosive properties	: No data available

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Oxidizing properties	:	No data available
Vapor pressure	:	No data available
Relative density	:	No data available
Relative vapor density at 20 °C	:	No data available
Molecular mass	:	400.11 g/mol
Solubility	:	No data available
Log Pow	:	No data available
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available

9.2. **Other information**

No additional information available

SECTI	SECTION 10: Stability and reactivity						
10.1.	Reactivity						
No addit	No additional information available						
10.2.	Chemical stability						
The proc	The product is stable at normal handling and storage conditions.						
10.3.	Possibility of hazardous reactions						
No addit	No additional information available						
10.4.	Conditions to avoid						
Keep away from heat, sparks and flame.							
10.5.	Incompatible materials						
Strong bases. Strong oxidizing agents. Strong reducing agents.							

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. Hazardous decomposition products in case of fire, see Section 5.

SECTION 11: Toxicological information 11.1. Information on toxicological effects

Acute toxicity	:	Oral: Harmful if swallowed.
Skin corrosion/irritation	:	Causes severe skin burns and eye damage.
Serious eye damage/irritation	:	Causes serious eye damage.
Respiratory or skin sensitization	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified
Specific target organ toxicity (single exposure)	:	May cause respiratory irritation.
Specific target organ toxicity (repeated exposure)	:	Not classified
Aspiration hazard	:	Not classified
Symptoms/injuries after inhalation	:	Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

SECTION 12: Ecological information						
12.1.	Toxicity					
No add	itional information available					
12.2.	Persistence and degradability					
No additional information available						
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12.3.	Bioaccumulative potential	
No additional information available		
12.4.	Mobility in soil	
No additional information available		
12 5	Other adverse effects	
12.0.		
No additional information available		

No additional information available

SECTION 13: Disposal consideration	IS
13.1. Waste treatment methods	
Waste treatment methods Waste disposal recommendations Additional information	 Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber. Dispose of contents/container in accordance with licensed collector's sorting instructions. Recycle the material as far as possible.
SECTION 14: Transport information	
Department of Transportation (DOT) In accordance with DOT Transport document description	: UN3261 Corrosive solid, acidic, organic, n.o.s., 8, II
UN-No.(DOT) Proper Shipping Name (DOT)	: UN3261 : Corrosive solid, acidic, organic, n.o.s.

Transport hazard class(es) (DOT) Hazard labels (DOT)

Packing group (DOT)

- DOT Packaging Non Bulk (49 CFR 173.xxx)
- DOT Packaging Bulk (49 CFR 173.xxx)

DOT Symbols

DOT Special Provisions (49 CFR 172.102)

- : 8 Class 8 Corrosive material 49 CFR 173.136
- : 8 Corrosive



- : II Medium Danger
- : 212
- : 240
- : G Identifies PSN requiring a technical name

: IB8 - Authorized IBCs: Metal (11A, 11B, 11N, 21A, 21B, 21N, 31A, 31B and 31N); Rigid plastics (11H1, 11H2, 21H1, 21H2, 31H1 and 31H2); Composite (11HZ1, 11HZ2, 21HZ1, 21HZ2, 31HZ1 and 31HZ2); Fiberboard (11G); Wooden (11C, 11D and 11F); Flexible (13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, 13M1 or 13M2). IP2 - When IBCs other than metal or rigid plastics IBCs are used, they must be offered for transportation in a closed freight container or a closed transport vehicle. IP4 - Flexible, fiberboard or wooden IBCs must be sift-proof and water-resistant or be fitted with a sift-proof and water-resistant liner. T3 - 2.65 178.274(d)(2) Normal..... 178.275(d)(2) TP33 - The portable tank instruction assigned for this substance applies for granular and powdered solids and for solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass. Solid substances transported or offered for transport above their melting point are authorized for transportation in portable tanks conforming to the provisions of portable tank instruction T4 for solid substances of packing group III or T7 for solid substances of packing group II, unless a tank with more stringent requirements for minimum shell thickness, maximum allowable working pressure, pressure-relief devices or bottom outlets are assigned in which case the more stringent tank instruction and special provisions shall apply. Filling limits must be in accordance with portable tank special provision TP3. Solids meeting the definition of an elevated temperature material must be transported in accordance with the applicable requirements of this subchapter. DOT Packaging Exceptions (49 CFR 173.xxx) : 154

DOT Quantity Limitations Passenger aircraft/rail : 15 kg (49 CFR 173.27)

DOT Quantity Limitations Cargo aircraft only (49 : 50 kg CFR 175.75)

Perfluorohexanesulfonic acid

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DOT Vessel Stowage Location	: B - (i) The material may be stowed "on deck" or "under deck" on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) "On deck only" on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
Other information	: No supplementary information available.
TDG	
No additional information available	
Transport by sea	
UN-No. (IMDG)	: 3261
Proper Shipping Name (IMDG)	: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S.
Class (IMDG)	: 8 - Corrosive substances
Packing group (IMDG)	: II - substances presenting medium danger
Air transport	
UN-No. (IATA)	: 3261
Proper Shipping Name (IATA)	: Corrosive solid, acidic, organic, n.o.s.
Class (IATA)	: 8 - Corrosives
Packing group (IATA)	: II - Medium Danger
SECTION 15: Regulatory information	tion
15.1. US Federal regulations	
Perfluorohexanesulfonic acid (355-46-4)

Listed on the United States TSCA (Toxic Substances Control Act) inventory			
EPA TSCA Regulatory Flag	S - S - indicates a substance that is identified in a proposed or final Significant New Uses Rule.		

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations	
CANADA	
Perfluorohexanesulfonic acid (355-46-4)	
Listed on the Canadian NDSL (Non-Domestic Substances List)	

EU-Regulations

No additional information available

National regulations

Perfluorohexanesulfonic acid (355-46-4)
Listed on the Japanese ISHL (Industrial Safety and Health Law)

15.3. US State regulations

California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

SECTION 16: Other information

Perfluorohexanesulfonic acid

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Full tex	t of H-phrases:				
	Acute Tox. 4 (Oral)		Acute toxicity (oral) Category 4		
	Eye Dam. 1		Serious eye damage/eye irritation Category 1		
[Skin Corr. 1B		Skin corrosion/irritation Category 1B		
[STOT SE 3		Specific target organ toxicity (single exposure) Category 3		
	H302		Harmful if swallowed		
	H314		Causes severe skin burns and eye damage		
[H318		Causes serious eye damage		
	H335		May cause respiratory irritation		
NFPA f NFPA f NFPA r	ealth hazard ire hazard eactivity	 : 3 - Short exposure could or residual injury even thoug given. : 0 - Materials that will not be 0 - Normally stable, even and are not reactive with ward or even the stable of the	cause serious temporary or h prompt medical attention was ourn. under fire exposure conditions, water.		
HMIS II	I Rating				
Health		: 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given			
Flammability :		: 0 Minimal Hazard - Mater	0 Minimal Hazard - Materials that will not burn		
Physica	ıl	: 0 Minimal Hazard - Mate react with water, polymer	rials that are normally stable, even under fire conditions, and will NOT ize, decompose, condense, or self-react. Non-Explosives.		

SDS US (GHS HazCom 2012)

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is offered solely for your consideration, investigation, and verification. It does not represent any guarantee of the properties of the product nor that the hazard precautions or procedures described are the only ones which exist. SynQuest shall not be held liable or any damage resulting from handling or from contact with the above product.



SAFETY DATA SHEET

Version 6.7 Revision Date 09/28/2020 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name	[:] Perfluorohexanoic acid
Product Number	: 43809
Brand	: Sigma-Aldrich
CAS-No.	: 307-24-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals, Synthesis of substances	atory chemicals, Synthesis of
-----------------	---	---	-------------------------------

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	:	+1 314 771-5765
Fax	:	+1 800 325-5052
Emergency telephone		

1.4 Emergency telephone

Emergency Phone #	: 800-424-9300 CHEMTREC (USA) +1-703-
	527-3887 CHEMTREC (International) 24
	Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger

Hazard statement(s) H314

Causes severe skin burns and eye damage.

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Precautionary statement(s)	
P264	Wash skin thoroughly after handling.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue
	rinsing. Immediately call a POISON CENTER/ doctor.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1	Substances Formula Molecular weight CAS-No. EC-No.	: C6HF11O2 : 314.06 g/mol : 307-24-4 : 206-196-6						
	Component		Classification	Concentration				
	Undecafluorohexanoic acid							
			Skin Corr. 1B; Eye Dam. 1; H314, H318	<= 100 %				

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

First aider needs to protect himself. Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

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If swallowed

After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable extinguishing media For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen fluoride Not combustible. Ambient fire may liberate hazardous vapours.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections For disposal see section 13.

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SECTION 7: Handling and storage

- **7.1 Precautions for safe handling** For precautions see section 2.2.
- **7.2 Conditions for safe storage, including any incompatibilities** Tightly closed.

Recommended storage temperature 2 - 8 °C

Store under argon. Storage class (TRGS 510): 8A: Combustible, corrosive hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

required

Body Protection

protective clothing

Respiratory protection

required when vapours/aerosols are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- a) Appearance Form: liquid
- b) Odor No data available
- c) Odor Threshold No data available

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d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 12 - 14 °C (54 - 57 °F)
f)	Initial boiling point and boiling range	157 °C 315 °F at 989.2 hPa
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
I)	Vapor density	No data available
m)	Relative density	1.757 g/cm3 at 20 °C (68 °F)
n)	Water solubility	insoluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	er safety informatio	n

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** no information available
- **10.5 Incompatible materials** Strong oxidizing agents
- **10.6 Hazardous decomposition products** Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen fluoride

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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

No data available Inhalation: No data available Dermal: No data available No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitization No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

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SECTION 12: Ecological information

12.1 Toxicity

No data available

- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted
- **12.6 Other adverse effects** No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and loc No mixing with other waste. Handle uncleaned containers like the product See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

UN number: 3265 Class: 8 Packing group: II Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (Undecafluorohexanoic acid) Reportable Quantity (RQ): Poison Inhalation Hazard: No

IMDG

UN number: 3265 Class: 8 Packing group: II EMS-No: F-A, S-B Proper shipping name: CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S. (Undecafluorohexanoic acid)

ΙΑΤΑ

UN number: 3265 Class: 8 Packing group: II Proper shipping name: Corrosive liquid, acidic, organic, n.o.s. (Undecafluorohexanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

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SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.7

Revision Date: 09/28/2020

Print Date: 06/19/2021

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SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

<u>1.1 - Product Identifiers</u>

Catalog Name: S-78941

Description: Perfluorohexane sulfonic acid in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc. 125 Market St. New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc. 1-203-502-7070 (USA) +001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements





* 2	HEALTH
3	FLAMMABILITY
0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

 $\ensuremath{\mathsf{H320}}$ - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION - continued

2.1 - GHS Label Elements - continued

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: Perfluorohexane sulfonic acid in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA - continued

			ACGIH -TLV (mg/m ³)			OSHA -PEL (mg/m ³)		
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
Perfluorohexane sulfonic acid	355-46-4	0.010						
Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Keep refrigerated.

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid Odor: N/A Odor Threshold: N/A pH: N/A Melting Point: -93.9 °C Boiling Point: 65 °C Flash Point: 52 °F (11 °C) (tcc) Evaporation Rate (Butyl Acetate=1): 5.9 Flammability Class: N/A Lower Flammability Level: 6.7 Upper Flammability Level: 6.7 Upper Flammability Level: 36.5 Vapor Pressure: 97 mmHg (20 °C) Vapor Density (Air = 1): 1.1 g/L Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES - continued

Solubility in Water: Very soluble Partition Coefficient: log Pow: -0.77 Autoignition Temperature: 385 °C Decomposition Temperature: N/A Viscosity: N/A VOC Content: N/A Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable Materials to Avoid: Acids Oxidizers Hazardous Decomposition: Oxides of carbon; Formaldehyde Hazardous Polymerization: Will not occur Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION - continued

UN Number: UN1230 Class: 3 Packing Group: II Proper Shipping Name: Methanol Poison by Inhalation: No Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

All components are listed on the TSCA Inventory.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

- 0 Minimal
- 1 Slight
- 2 Moderate
- 3 Serious
- 4 Severe
- * Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe Category 5 - Least Severe

**** End of Document ****



SAFETY DATA SHEET

Santa Cruz Biotechnology, Inc. Revision date 11-Dec-2015 Version 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier Product Name

Product Name Product Code Perfluorononanoic acid SC-250678

Recommended use of the chemical and restrictions on use For research use only. Not intended for diagnostic or therapeutic use.

Details of the supplier of the safety data sheet

Santa Cruz Biotechnology, Inc. 10410 Finnell Street Dallas, TX 75220 831.457.3800 800.457.3801 scbt@scbt.com Emergency telephone number Chemtrec 1.800.424.9300 (Within USA) +1.703.527.3887 (Outside USA)

2. HAZARDS IDENTIFICATION

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Classification

Skin corrosion/irritation Serious eye damage/eye irritation

Label elements Signal word Hazard statements

Symbols/Pictograms

Precautionary Statements - Prevention

Precautionary Statements - Response

Precautionary Statements - Storage Precautionary Statements - Disposal Category 1 Sub-category C Category 1

Danger Causes severe skin burns and eye damage



Do not breathe dust/fume/gas/mist/vapors/spray Wash face, hands and any exposed skin thoroughly after handling Wear protective gloves/protective clothing/eye protection/face protection Immediately call a POISON CENTER or doctor/physician IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsina Immediately call a POISON CENTER or doctor/physician IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower Wash contaminated clothing before reuse IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Immediately call a POISON CENTER or doctor/physician IF SWALLOWED: Rinse mouth. DO NOT induce vomiting Store locked up Dispose of contents/container to an approved waste disposal plant



Hazards not otherwise classified (HNOC)

Hazards not otherwise classified (HNOC)

Health hazards

Physical and chemical

Flammability

Stability

properties

Other Information

Unknown acute toxicity

NFPA

Not applicable

100% of the mixture consists of ingredient(s) of unknown toxicity.



3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Weight %	Oral LD50	Dermal LD50	Inhalation LC50
Perfluorononanoic acid	375-95-1	>98	-	-	-

4. FIRST AID MEASURES

General advice	Consult a physician if pecessary. Remove to fresh air
Eve contact	Wash with planty of water
Eve contact	Wash with picture and water
Skin Contact	Wash skin with soap and water.
Inhalation	Remove to fresh air If breathing is difficult, give oxygen If not breathing, give artificial respiration
Ingestion	Never give anything by mouth to an unconscious person. Clean mouth with water.

Most important symptoms and effects, both acute and delayedSymptomsNo information available.

Indication of any immediate medical attention and special treatment needed Note to physicians Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Suitable Extinguishing Media	Use extinguishing measures that are appropriate to local circumstances and the
Unsuitable Extinguishing Media	None.
Specific hazards arising from the	ne chemical
Specific hazards arising from the chemical	Thermal decomposition can lead to release of toxic/corrosive gases and vapors.
Hazardous combustion products	Hydrogen fluoride. Carbon oxides. Phosgene.
Explosion data	
Sensitivity to Mechanical Impact	No information available.
Sensitivity to Static Discharge	No information available.



Protective equipment and precautions for firefighters

Protective equipment and precautions As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Ensure adequate ventilation, especially in confined areas.

Environmental precautions

Environmental precautions See Se

See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for containment Methods for cleaning up Prevent further leakage or spillage if safe to do so. Use personal protective equipment as required. Cover powder spill with plastic sheet or tarp to minimize spreading and keep powder dry. Take up mechanically, placing in appropriate containers for disposal. Avoid creating dust. Clean contaminated surface thoroughly.

7. HANDLING AND STORAGE

Precautions for safe handling Advice on safe handling	Thermal decomposition can lead to release of toxic/corrosive gases and vapors.
Conditions for safe storage, incl	uding any incompatibilities
Storage Conditions	Keep containers tightly closed in a dry, cool and well-ventilated place. Store at room temperature.
Incompatible materials	None known based on information supplied.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters Exposure Guidelines	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Appropriate engineering controls Engineering Controls	s Showers Eyewash stations Ventilation systems
Individual protection measures, Eye/face protection Skin and Body Protection Respiratory protection General Hygiene Considerations	such as personal protective equipment Wear safety glasses with side shields (or goggles). Wear protective gloves and protective clothing. If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations. Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical State Appearance Odor

Property

pН Melting point/freezing point Boiling point Flash point Density Evaporation rate Upper flammability limits Lower flammability limit Vapor pressure Vapor density Specific gravity Water solubility Solubility in other solvents Partition coefficient Autoignition temperature Decomposition temperature Kinematic viscosity Explosive properties Oxidizing properties

Solid crystalline powder No information available

Values

No information available 63 °C 218 °C No information available No information available

10. STABILITY AND REACTIVITY

Reactivity	Not applicable
Chemical stability	Stable under recommended storage conditions.
Possibility of Hazardous Reactions	None under normal processing.
Hazardous polymerization	No information available.
Conditions to avoid	Extremes of temperature and direct sunlight.
Incompatible materials	Strong oxidizing agents.
Hazardous Decomposition Products	Hydrogen fluoride. Carbon oxides. Phosgene.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Inhalation	No data available.
Eye contact	No data available.
Skin Contact	No data available.
Ingestion	No data available.

Information on toxicological effects

Symptoms

No information available.

Delayed and immediate effects as well as chronic effects from short and long-term exposure Chronic Toxicity No information available.

Numerical measures of toxicity - Product Information

Unknown acute toxicity 100% of the mixture consists of ingredient(s) of unknown toxicity

12. ECOLOGICAL INFORMATION



-0000	

May cause long lasting harmful effects to aquatic life

100% of the mixture consists of components(s) of unknown hazards to the aquatic environment.

Persistence and degradability	No information available.
Bioaccumulation	No information available.
Mobility	No information available.

13. DISPOSAL CONSIDERATIONS

Disposal of wastes	Disposal should be in accordance with applicable regional, national and local laws and
	regulations.
Contaminated packaging	Do not reuse container.

14. TRANSPORT INFORMATION

DOT	Not regulated
IMDG	Not regulated
ΙΑΤΑ	Not regulated

15. REGULATORY INFORMATION

International Inventories

All of the components in the product are on the following Inventory lists

TSCA (United States): Canada (DSL/NDSL) Europe (EINECS/ELINCS/NLP) ENCS (Japan):

Chemical Name	TSCA	DSL	NDSL	EINECS	ELINCS	ENCS	IECSC	KECL	PICCS	AICS
Perfluorononanoic acid	Х	-	Х	Х	-	Х	-	-	-	-

X - Listed

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

SARA 311/312 Hazard Categories

Acute health hazard	NO
Chronic Health Hazard	No
Fire hazard	No
Sudden release of pressure hazard	No
Reactive hazard	No



CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42).

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

This product does not contain any substances regulated by state right-to-know regulations

16. OTHER INFORMATION

Revision note

No information available

Disclaimer

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet



SAFETY DATA SHEET

Version 6.4 Revision Date 04/18/2021 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

1.2	Relevant identified up	ses	of the substance or mixture and uses advised against
	CAS-No.	:	335-67-1
	Brand	:	Aldrich
	Product Number	:	171468
	Product name	:	Perfluorooctanoic acid

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 6310 UNITED STATES	3
Telephone Fax	: +1 314 771-5765 : +1 800 325-5052	

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 1B), H360 Effects on or via lactation, H362 Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Aldrich - 171468

Page 1 of 10



Signal word	Danger
Hazard statement(s) H302 H314 H351 H360 H362 H372	Harmful if swallowed. Causes severe skin burns and eye damage. Suspected of causing cancer. May damage fertility or the unborn child. May cause harm to breast-fed children. Causes damage to organs (Liver) through prolonged or repeated exposure.
Precautionary statement(s)	
P201 P202	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P301 + P330 + P331	IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P304 + P340 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 +	IF IN EYES: Rinse cautiously with water for several minutes.
P310	Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

.1	Substances Synonyms Formula	:	Pentadecafluoroocta Perfluorocaprylic ac Perfluorooctanoic ac C8HF15O2	anoic acid id cid	
	Molecular weight	:	414.07 g/mol		
	CAS-No.	:	335-67-1		
	EC-No.	:	206-397-9		
	Component			Classification	Concentration
	pentadecafluorooc	anoi	c acid		
				Acute Tox. 4; Skin Corr.	<= 100 %

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1B; Eye Dam. 1; Carc. 2;	
Repr. 1B; Lact. ; STOT RE	
1; H302, H314, H318,	
H351, H360, H362, H372	

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides Hydrogen fluoride Combustible. Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

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5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures** Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.
- **6.2 Environmental precautions** Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.

6.4 Reference to other sections For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

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8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: > 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: > 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the EC approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Acid-resistant protective clothing

Respiratory protection

required when dusts are generated. Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a) Appearance Form: flakes Color: colorless

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b)	Odor	stinging			
c)	Odor Threshold	No data available			
d)	рН	2.6 at 1 g/l at 20 °C (68 °F)			
e)	Melting point/freezing point	Melting point/range: 55 - 56 °C (131 - 133 °F) - lit.			
f)	Initial boiling point and boiling range	189 °C 372 °F at 981 hPa - lit.			
g)	Flash point	No data available			
h)	Evaporation rate	No data available			
i)	Flammability (solid, gas)	No data available			
j)	Upper/lower flammability or explosive limits	No data available			
k)	Vapor pressure	0.69 hPa at 25 °C (77 °F)			
I)	Vapor density	No data available			
m)	Relative density	No data available			
n)	Water solubility	3.4 g/l at 20 °C (68 °F)			
o)	Partition coefficient: n-octanol/water	log Pow: 6.30 - Potential bioaccumulation, (Lit.)			
p)	Autoignition temperature	No data available			
q)	Decomposition temperature	> 300 °C (> 572 °F) -			
r)	Viscosity	No data available			
s)	Explosive properties	No data available			
t)	Oxidizing properties	No data available			
Oth	Other safety information				

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with: Strong oxidizing agents Strong acids Bases

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10.4 Conditions to avoid no information available

- **10.5 Incompatible materials** No data available
- **10.6 Hazardous decomposition products** In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity Acute toxicity estimate Oral - 500.1 mg/kg

(Expert judgment)

Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l (Expert judgment)

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Germ cell mutagenicity

No data available

No data available No data available

Carcinogenicity

Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (pentadecafluorooctanoic acid)

- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

May damage the unborn child. Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure

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Specific target organ toxicity - repeated exposure Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard

11.2 Additional Information

RTECS: RH0781000

Cough, Shortness of breath, Headache, Nausea, Vomiting To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain Nausea Vomiting Drowsiness somnolence

Handle in accordance with good industrial hygiene and safety practice.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (pentadecafluorooctanoic acid)
Toxicity to algae	Remarks: No data available (pentadecafluorooctanoic acid)

12.2 Persistence and degradability

No data available

12.3 Bioaccumulative potential No data available

12.4 Mobility in soil

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Discharge into the environment must be avoided.

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SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

UN number: 3261 Class: 8 Packing group: III Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid) Reportable Quantity (RQ): Poison Inhalation Hazard: No

IMDG

UN number: 3261 Class: 8 Packing group: III EMS-No: F-A, S-B Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (pentadecafluorooctanoic acid)

ΙΑΤΑ

UN number: 3261 Class: 8 Packing group: III Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

pentadecafluorooctanoic acid	CAS-No.	Revision Date
	335-67-1	2018-02-01

New Jersey Right To Know Components

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SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.4

Revision Date: 04/18/2021

Print Date: 06/19/2021

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Material Safety Data Sheet

HAZARD WARNING	GS	RIS	K PHRASES			PROTECTIVE CLOTHING	
	Corrosive to Toxic compo this material. Environment This material term adverse POSSIBLE M	Corrosive to eyes and skin on contact. Toxic compound, do not ingest or inhale. Avoid all contact with this material. Environmental hazard. This material is toxic to aquatic organisms and may cause long term adverse effects to the aquatic environment. POSSIBLE MUTAGEN. MINIMIZE EXPOSURE.			ith 1g)	
Section I. C	Chemical Produ	uct and Co	mpany Ide	entification			
Chemical Name	Heptade	cafluoro	octanes	sulfonic A	\cid		
Catalog Number	H0781	H0781 Supplier TCI America					
Synonym	Perfluorooctane	Perfluorooctanesulfonic Acid			9 P 1	Portland OR 1-800-423-8616	
Chemical Formula	C ₈ HF ₁₇ O ₃ S						
CAS Number	1763-23-1			Emer Call	se of Crgency (8	Chemtrec® 800) 424-9300 (U.S.) 703) 527-3887 (International)	
Section II.	Composition a	nd Informa	tion on In	gredients			
Chemical M	Name	CAS Number	Percent (%)	TLV/PI	EL	Toxicology Data	
Heptadecafluoroocta	nesulfonic Acid	1763-23-1	Min. 98.0 (T)	This compound is of a possible mutager no acceptable export a mutagen.	classified as n. There is osure limit for	Rat LD $_{50}$ (oral) 154 mg/kg	
Section III.	Hazards Identi	fication					
Acute Health Effects	Corrosive to skin, membranes of the damage or blindnu coughing, choking, Toxic if ingested or Follow safe industr	eyes, and respirate eyes, mouth and i ess. Inhalation of or shortness of bre inhaled. Avoid pro ial hygiene practice	ory system. Liqu respiratory tract. the spray mist eath. Corrosive n olonged contact w is and always wea	id or spray mist ma Skin contact may p may produce sever naterials may cause <i>i</i> th this material. Ov ar proper protective	y produce tis produce burns e irritation of serious injury rerexposure mequipment wh	sue damage, particularly in mucous s. Eye contact can result in corneal f respiratory tract, characterized by r if ingested. nay result in serious illness or death. nen handling this compound.	
Chronic Health Effects	CARCINOGENIC E MUTAGENIC EFF TERATOGENIC EF DEVELOPMENTAI Rat TDLo Oral 50 r TOXIC EFFECTS: Effects on Newborn Effects on Newborn Rat TDLo Oral 100 TOXIC EFFECTS: Effects on Newborn Rat TDLo Unreport TOXIC EFFECTS: Specific Developm Effects on Newborn Repeated exposure skin destruction, of damage. Repeate one or many huma	EFFECTS : Not av ECTS : Not availal EFECTS : Not availal end, growth statistics mg/kg, female 19-2 m - Other neonatal m of Growth statistics mg/kg, female 19- m - Stillbirth ted 50 mg/kg, female ental Abnormalities m - Live birth index e of the eyes to a lo for dermatitis. Repid exposure to an h m organs.	ailable. ble. ilable. o days of pregnar measures or effects. 20 days of pregnar ble 19-20 days of pregnar is - Respiratory sys pw level of dust c eated inhalation ighly toxic materi	ncy :ts ancy pregnancy stem an produce eye irritz of dust can produc al may produce gen	ation. Repeat e varying deţ eral deteriora	ted skin exposure can produce local gree of respiratory irritation or lung tion of health by an accumulation in	
Section IV.	First Aid Measu	ures					
Eye Contact	Check for and rem minutes. Get medi	nove any contact le	enses. In case o	f contact, immediat	ely flush eye:	s with plenty of water for at least 15	
Skin Contact	In case of contact, and shoes. Wash	immediately flush clothing before reus	skin with plenty of se. Thoroughly c	of water for at least lean shoes before re	15 minutes w euse. Get me	while removing contaminated clothing dical attention immediately.	
Inhalation	If the victim is not waistband. If breat improve.	breathing, perform thing is difficult, c	m mouth-to-mou oxygen can be a	th resuscitation. Lo	oosen tight c medical atte	lothing such as a collar, tie, belt o notion if respiration problems do no	
Ingestion	DO NOT INDUCE perform mouth-to-r	VOMITING. Loos nouth resuscitation	en tight clothing . Examine the lip	such as a collar, tie is and mouth to asce	, belt or wais	tband. If the victim is not breathing r the tissues are damaged, a possible	

H0781	Heptadeca	fluorooctanesulfo	nic Acid Page 2				
Section V.	Fire and Explosion Data						
Flammability	May be combustible at high temperature.	Auto-Ignition	Not available.				
Flash Points	Not available.	Flammable Limits	Not available.				
Combustion Products	These products are toxic carbon oxides (CO WARNING: Highly toxic HF gas is produced	These products are toxic carbon oxides (CO, CO ₂), halogenated compounds, sulfur oxides (SO _x). WARNING: Highly toxic HF gas is produced during combustion.					
Fire Hazards	Not available.	Not available.					
Explosion Hazards	Risks of explosion of the product in presence Risks of explosion of the product in presence	Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.					
Fire Fighting Media and Instructions	SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam Consult with local fire authorities before atter	SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. DO NOT use water jet. Consult with local fire authorities before attempting large scale fire-fighting operations.					
Section VI.	Accidental Release Measures	S					
Spill Cleanup Instructions	Corrosive material. Toxic material. Environn Stop leak if without risk. DO NOT get wate vapors. Prevent entry into sewers, baseme federal, state, and/or local authorities for ass	nentally hazardous material. Pos er inside container. DO NOT to ents or confined areas; dike if ne sistance on disposal.	sibly mutagenic material. buch spilled material. Use water spray to reduce beded. Eliminate all sources of ignition. Consult				
Section VII.	Handling and Storage						
Handling and Storage Information	CORROSIVE. TOXIC. ENVIRONMENTAL away from heat. Mechanical exhaust requ Avoid excessive heat and light. DO NOT protective clothing. If ingested, seek medica and supportively. Always store away from incompatible compo	CORROSIVE. TOXIC. ENVIRONMENTAL HAZARD. POSSIBLE MUTAGEN. Keep locked up. Keep container dry. Keep away from heat. Mechanical exhaust required. When not in use, tightly seal the container and store in a dry, cool place. Avoid excessive heat and light. DO NOT ingest. Do not breathe dust. Never add water to this product. Wear suitable protective clothing. If ingested, seek medical advice immediately and show the container or the label. Treat symptomatically and supportively. Always store away from incompatible compounds such as oxidizing agents. alkalis (bases).					
Section VIII.	Exposure Controls/Personal	Protection					
Engineering Controls	Use process enclosures, local exhaust vent exposure limits. If user operations generat below the exposure limit.	Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.					
Personal Protection	Face shield. Lab coat. Dust respirator. inhalation of the product. Suggested prot product.	Face shield. Lab coat. Dust respirator. Boots. Gloves. A MSHA/NIOSH approved respirator must be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.					
Exposure Limits	This compound is classified as a possible m	This compound is classified as a possible mutagen. There is no acceptable exposure limit for a mutagen.					
Section IX.	Physical and Chemical Prope	erties					
Physical state @ 20°C	Solid. (White crystal ~ powder.)	Solubility	Soluble in water.				
Specific Gravity	Not available.						
Molecular Weight	500.13	Partition Coefficient	Not available.				
Boiling Point	260 ℃ (500 °F)	Vapor Pressure	0.3 Pa (@ 25℃)				
Melting Point	90℃ (194°F)	Vapor Density	Not available.				
Refractive Index	Not available.	Volatility	Not available.				
Critical Temperature	Not available.	Odor	Not available.				
Viscosity	Not available.	Taste	Not available.				
Section X.	Stability and Reactivity Data						
Stability	This material is stable if stored under proper	r conditions. (See Section VII for	instructions)				
Conditions of Instability	Avoid excessive heat and light.						
Incompatibilities	Reactive with oxidizing agents, alkalis (base	25).					

H0781	Heptadecafluorooctanesulfonic Acid Page 3
Section XI.	Toxicological Information
RTECS Number	RG9701600
Routes of Exposure	Eye Contact. Ingestion. Inhalation. Skin contact.
Toxicity Data	Rat LD ₅₀ (oral) 154 mg/kg
Chronic Toxic Effects	CARCINOGENIC EFFECTS : Not available. MUTAGENIC EFFECTS : Not available. TERATOGENIC EFFECTS : Not available. DEVELOPMENTAL TOXICITY: Reproductive effects. Rat TDLo Oral 50 mg/kg, female 19-20 days of pregnancy TOXIC EFFECTS: Effects on Newborn - Viability index Effects on Newborn - Other neonatal measures or effects Effects on Newborn - Other neonatal measures or effects Effects on Newborn - Growth statistics Rat TDLo Oral 100 mg/kg, female 19-20 days of pregnancy TOXIC EFFECTS: Effects on Newborn - Stillbirth Rat TDLo Oral 100 mg/kg, female 19-20 days of pregnancy TOXIC EFFECTS: Effects on Newborn - Stillbirth Rat TDLo Unreported 50 mg/kg, female 19-20 days of pregnancy TOXIC EFFECTS: Specific Developmental Abnormalities - Respiratory system Effects on Newborn - Live birth index Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to an highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.
Acute Toxic Effects	Corrosive to skin, eyes, and respiratory system. Liquid or spray mist may produce tissue damage, particularly in mucous membranes of the eyes, mouth and respiratory tract. Skin contact may produce burns. Eye contact can result in corneal damage or blindness. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Corrosive materials may cause serious injury if ingested. Toxic if ingested or inhaled. Avoid prolonged contact with this material. Overexposure may result in serious illness or death. Follow safe industrial hygiene practices and always wear proper protective equipment when handling this compound.
Section XII.	Ecological Information
Ecotoxicity	Not available.
Environmental Fate	Perfluorooctane sulfonic acid's production and use as a precursor for fluorinated surfactants has resulted in its release to the environment through various waste streams. If released to air, an estimated vapor pressure of 2.0X10-3 mm Hg at 25 deg C indicates perfluorooctane sulfonic acid will exist solely as a vapor in the ambient atmosphere. Vapor-phase perfluorooctane sulfonic acid will be degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 110 days. If released to soil, perfluorooctane sulfonic acid is expected to have no mobility based upon an estimated Koc of 100,000. Perfluorooctane sulfonic acid is essentially nonvolatile. Perfluoro compound recalcitrance can be attributed to the stability conferred by fluorine substitutes and the absence of structures susceptible to electrophilic or nucleophilic attack. Perfluorooctane sulfonic acid reached 0% of its theoretical BOD in four weeks using an activated sludge inoculum in the manometric respirometry test. If released into water, perfluorooctane sulfonic acid is expected to be an important fate process as the compound is essentially nonvolatile; an estimated volatilization half-life for a model pond is 3 years if adsorption is considered. An estimated BCF of 56 suggests the potential for bioconcentration in aquatic organisms is moderate. Monitoring studies however would suggest that this compound is highly bioaccumulative. As a class, fluorinated organic compounds are resistant to hydrolysis. Occupational exposure to perfluorooctane sulfonic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluorooctane sulfonic acid is produced or used. Monitoring data indicate that the general population may be exposed to perfluorooctane sulfonic acid via ingestion of contaminated fish and drinking water, and dermal contact with this compound and other products containing perfluorooctane sulfonic acid.
Section XIII.	Disposal Considerations
Waste Disposal	Recycle to process, if possible. Consult your local regional authorities. You may be able to dissolve or mix material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber system. Observe all federal, state and local regulations when disposing of the substance.
Section XIV.	Transport Information
DOT Classification	DOT CLASS 8: Corrosive material DOT CLASS 6.1: Toxic material
PIN Number	UN2923
Proper Shipping Name	Corrosive solid, toxic, n.o.s.
Packing Group (PG)	II
DOT Pictograms	CONSISTER POISON

Continued on Next Page
	-
Section XV.	Other Regulatory Information and Pictograms
TSCA Chemical Invento (EPA)	This compound is ON the EPA Toxic Substances Control Act (TSCA) inventory list.
WHMIS Classification (Canada)	CLASS D-1B: Material causing immediate and serious toxic effects (TOXIC). CLASS E: Corrosive solid. On NDSL.
EINECS Number (EEC	217-179-8
EEC Risk Statements	R23/24/25- Toxic by inhalation, in contact with skin and if swallowed. R34- Causes burns. R46- May cause heritable genetic damage. R47- May cause birth defects. R51- Toxic to aquatic organisms. R53- May cause long-term adverse effects in the aquatic environment.
Japanese Regulatory Da	a ENCS No. 2-1595

Heptadecafluorooctanesulfonic Acid

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Section XVI. Other Information

Version 1.0 Validated on 1/6/2010. Printed 1/6/2010.

H0781

Notice to Reader

TCI laboratory chemicals are for research purposes only and are NOT intended for use as drugs, food additives, households, or pesticides. The information herein is believed to be correct, but does not claim to be all inclusive and should be used only as a guide. Neither the above named supplier nor any of its subsidiaries assumes any liability whatsoever for the accuracy or completeness of the information contained herein. Final determination of suitability of any material is the sole responsibility of the user. All chemical reagents must be handled with the recognition that their chemical, physiological, toxicological, and hazardous properties have not been fully investigated or determined. All chemical reagents should be handled only by individuals who are familiar with their potential hazards and who have been fully trained in proper safety, laboratory, and chemical handling procedures. Although certain hazards are described herein, we can not guarantee that these are the only hazards which exist. Our MSDS sheets are based only on data available at the time of shipping and are subject to change without notice as new information is obtained. Avoid long storage periods since the product is subject on degradation with age and may become more dangerous or hazardous. It is the responsibility of the user to request updated MSDS sheets for products that are stored for extended periods. Disposal of unused product must be undertaken by qualified personnel who are knowledgeable in all applicable regulations and follow all pertinent safety precautions including the use of appropriate protective equipment (e.g. protective goggles, protective clothing, breathing equipment, facial mask, fume hood). For proper handling and disposal, always comply with federal, state, and local regulations.

Printed 1/6/2010.



SAFETY DATA SHEET

Version 6.2 Revision Date 04/30/2021 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

	Product name	:	Perfluoropentanoic acid
	Product Number Brand CAS-No.	:	396575 Aldrich 2706-90-3
1.2	Relevant identified	uses	of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES	
Telephone Fax	: +1 314 771-5765 : +1 800 325-5052	

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Serious eye damage (Category 1), H318 Reproductive toxicity (Category 2), H361

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Danger

Signal word Hazard statement(s) H318 H361

Causes serious eye damage. Suspected of damaging fertility or the unborn child.

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Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P305 + P351 + P338 +	IF IN EYES: Rinse cautiously with water for several minutes.
P310	Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER/ doctor.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

.1	Substances Synonyms	:	Nonafluorovaleric Perfluoropentanoio Nonafluoropentano	acid c acid oic acid	
	Formula Molecular weight CAS-No. EC-No.	::	C ₅ HF ₉ O ₂ 264.05 g/mol 2706-90-3 220-300-7		
	Component			Classification	Concentration
	Perfluorovaleric aci	d			
				Eye Dam. 1; Repr. 2; H318, H361	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Call in physician.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

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If swallowed

After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

- **4.2 Most important symptoms and effects, both acute and delayed** The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides Hydrogen fluoride Combustible. Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.

For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections For disposal see section 13.

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SECTION 7: Handling and storage

7.1 Precautions for safe handling For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class (TRGS 510): 8A: Combustible, corrosive hazardous materials

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Change contaminated clothing. Preventive skin protection recommended. Wash hands after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

required

Body Protection

protective clothing

Respiratory protection

required when vapours/aerosols are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

- a) Appearance Form: clear, liquid Color: light brown
- b) Odor No data available

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c)	Odor Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	140 °C 284 °F - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
I)	Vapor density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available

9.2 Other safety information No data available

SECTION 10: Stability and reactivity

- 10.1 Reactivity No data available
- **10.2 Chemical stability** The product is chemically stable under standard ambient conditions (room temperature) .
- 10.3 Possibility of hazardous reactions No data available
- **10.4 Conditions to avoid** no information available
- **10.5 Incompatible materials** Strong oxidizing agents

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10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute toxicity estimate Oral - 2,501 mg/kg (Expert judgment)

Inhalation: No data available

Dermal: No data available No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitization No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

Suspected of damaging the unborn child. No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

No data avallable

11.2 Additional Information

Not available

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Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., Cough, Shortness of breath, Headache, Nausea

SECTION 12: Ecological information

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)

Not dangerous goods

IMDG Not dangerous goods

IATA Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

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SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.2

Revision Date: 04/30/2021

Print Date: 06/19/2021

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SAFETY DATA SHEET

Version 6.3 Revision Date 09/17/2020 Print Date 06/19/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

	Product name	:	Perfluorotetradecanoic acid
	Product Number Brand CAS-No.	::	446785 Aldrich 376-06-7
1.2	L.2 Relevant identified uses of the substance or mixture and uses advised aga		of the substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances
1.3	Details of the supplier	of	the safety data sheet

Company	: Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	: +1 314 771-5765
Fax	: +1 800 325-5052

1.4 Emergency telephone

Emergency Phone #

: 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	C ₁₄ HF ₂₇ O ₂
Molecular weight	:	714.11 g/mol
CAS-No.	:	376-06-7

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EC-No.

: 206-803-4

No components need to be disclosed according to the applicable regulations.

SECTION 4: First aid measures

4.1 Description of first-aid measures

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact

Wash off with soap and plenty of water.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water.

- **4.2 Most important symptoms and effects, both acute and delayed** The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen fluoride

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures** Avoid dust formation. Avoid breathing vapors, mist or gas. For personal protection see section 8.
- **6.2 Environmental precautions** Do not let product enter drains.
- **6.3 Methods and materials for containment and cleaning up** Sweep up and shovel. Keep in suitable, closed containers for disposal.
- **6.4** Reference to other sections For disposal see section 13.

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SECTION 7: Handling and storage

7.1 Precautions for safe handling

Provide appropriate exhaust ventilation at places where dust is formed.Normal measures for preventive fire protection.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): 13: Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls General industrial hygiene practice.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Do not let product enter drains.

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SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: solid
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 130 - 135 °C (266 - 275 °F) - lit.
f)	Initial boiling point and boiling range	270 °C 518 °F at 987 hPa - lit.
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
I)	Vapor density	No data available
m)	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth	ner safetv informatio	n

9.2 Other safety informa No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available

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10.4 Conditions to avoid No data available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

Hazardous decomposition products formed under fire conditions. - Carbon oxides, Hydrogen fluoride

Other decomposition products - No data available In the event of fire: see section $\ensuremath{\mathsf{5}}$

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Skin corrosion/irritation No data available

Serious eye damage/eye irritation Causes serious eye damage.

Respiratory or skin sensitization

Germ cell mutagenicity

No data available No data available No data available

Carcinogenicity

Suspected of causing cancer.

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

May damage the unborn child. Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard

Additional Information

RTECS: Not available

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burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain, Nausea, Vomiting, Drowsiness, somnolence Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia Remarks: No data available(Perfluorotetradecanoic acid) and other aquatic invertebrates

Toxicity to algae Remarks: No data available(Perfluorotetradecanoic acid)

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

SECTION 14: Transport information

DOT (US)

Not dangerous goods

IMDG

Not dangerous goods

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IATA Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

No SARA Hazards

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

Perfluorotetradecanoic acid	CAS-No. 376-06-7	Revision Date	
New Jersey Right To Know Components Perfluorotetradecanoic acid	CAS-No. 376-06-7	Revision Date	

California Prop. 65 Components

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

SECTION 16: Other information

Further information

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The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.3 Revision Date: 09/17/2020 Print Date: 06/19/2021

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SAFETY DATA SHEET

Version 6.2 Revision Date 07/16/2021 Print Date 07/25/2021

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

	Product name	:	Perfluoroundecanoic acid
	Product Number Brand CAS-No.	:	446777 Aldrich 2058-94-8
1.2	Relevant identified	uses	of the substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich Inc. 3050 SPRUCE ST ST. LOUIS MO 63103 UNITED STATES
Telephone	:	+1 314 771-5765
Fax	:	+1 800 325-5052
Emergency telephone		

1.4 Emergency telephone

: 800-424-9300 CHEMTREC (USA) +1-703-Emergency Phone # 527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Acute toxicity, Inhalation (Category 4), H332 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 1B), H360 Effects on or via lactation, H362 Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Danger

Signal word Aldrich - 446777

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Hazard statement(s)	
H302 + H332	Harmful if swallowed or if inhaled.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs (Liver) through prolonged or repeated exposure.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER/ doctor if you feel unwell.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.1 Substances

Formula	:	C ₁₁ HF ₂₁ O ₂
Molecular weight	:	564.09 g/mol
CAS-No.	:	2058-94-8
EC-No.	:	218-165-4

Component	Classification	Concentration
Henicosafluoroundecanoic acid		
	Acute Tox. 4; Carc. 2;	<= 100 %
	Repr. 1B; Lact. ; STOT RE	
	1; H302, H332, H351,	
	H360, H362, H372	

For the full text of the H-Statements mentioned in this Section, see Section 16.

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SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice

Show this material safety data sheet to the doctor in attendance.

If inhaled

After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact

In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact

After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed

After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media

Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media

For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Nature of decomposition products not known. Combustible. Vapors are heavier than air and may spread along floors.

Forms explosive mixtures with air on intense heating.

Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

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SECTION 6: Accidental release measures

- **6.1 Personal precautions, protective equipment and emergency procedures** Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert. For personal protection see section 8.
- **6.2 Environmental precautions** Do not let product enter drains.
- **6.3 Methods and materials for containment and cleaning up** Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area. Avoid generation of dusts.
- **6.4 Reference to other sections** For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons. Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

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Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

Handle with impervious gloves.

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:KCL 741 Dermatril® L

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:KCL 741 Dermatril® L

Body Protection

protective clothing

Respiratory protection

required when dusts are generated.

Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure

Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Form: solid a) Appearance b) Odor No data available c) Odor Threshold No data available No data available d) pH e) Melting Melting point/range: 96 - 101 °C (205 - 214 °F) - lit. point/freezing point 160 °C 320 °F at 80 hPa - lit. Initial boiling point f) and boiling range g) Flash point 113 °C (235 °F) - closed cup h) Evaporation rate No data available i) Flammability (solid, No data available

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gas)

j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
I)	Vapor density	No data available
m)	Density	No data available
	Relative density	No data available
n)	Water solubility	No data available
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Other safety information		

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

9.2

Forms explosive mixtures with air on intense heating. A range from approx. 15 Kelvin below the flash point is to be rated as critical. The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions No data available

10.4 Conditions to avoid

Strong heating.

- **10.5 Incompatible materials** Oxidizing agents
- **10.6 Hazardous decomposition products** In the event of fire: see section 5

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SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute toxicity estimate Oral - 500.1 mg/kg (Expert judgment) Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l (Expert judgment) Dermal: No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation

Causes serious eye damage.

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available No data available No data available

Carcinogenicity

Suspected of causing cancer.

- IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity

May damage the unborn child. Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

Causes damage to organs through prolonged or repeated exposure. - Liver

Aspiration hazard

No data available

11.2 Additional Information

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain Nausea

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Handle in accordance with good industrial hygiene and safety practice.

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (Henicosafluoroundecanoic acid)
Toxicity to algae	Remarks: No data available (Henicosafluoroundecanoic acid)

12.2 Persistence and degradability No data available

- **12.3 Bioaccumulative potential** No data available
- **12.4 Mobility in soil** No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US) Not dangerous goods

IMDG Not dangerous goods

ΙΑΤΑ

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Not dangerous goods

Further information

Not classified as dangerous in the meaning of transport regulations.

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components Henicosafluoroundecanoic acid	CAS-No. 2058-94-8	Revision Date
New Jersey Right To Know Components Henicosafluoroundecanoic acid	CAS-No. 2058-94-8	Revision Date

SECTION 16: Other information

Further information

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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SAFETY DATA SHEET

Creation Date 01-May-2012 Revision Date 11-Aug-2014 **Revision Number** 1 1. Identification Phenanthrene **Product Name** Cat No. : AC130090000; AC130090050; AC130090500; AC130095000 No information available **Synonyms Recommended Use** Laboratory chemicals. Uses advised against No Information available Details of the supplier of the safety data sheet Company Entity / Business Name **Emergency Telephone Number** For information US call: 001-800-ACROS-01 **Fisher Scientific** Acros Organics One Reagent Lane One Reagent Lane / Europe call: +32 14 57 52 11 Fair Lawn, NJ 07410 Fair Lawn, NJ 07410 Emergency Number US:001-201-796-7100 /

2. Hazard(s) identification

Classification

Tel: (201) 796-7100

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity

Category 4

Europe: +32 14 57 52 99

Europe:001-703-527-3887

CHEMTREC Tel. No.US:001-800-424-9300 /

Label Elements

Signal Word Warning

Hazard Statements Harmful if swallowed



Precautionary Statements Prevention Wash face, hands and any exposed skin thoroughly after handling Do not eat, drink or smoke when using this product Ingestion IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell Rinse mouth

Disposal

Dispose of contents/container to an approved waste disposal plant <u>Hazards not otherwise classified (HNOC)</u> Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component		CAS-No	Weight %
Phenanthrene		85-01-8	>95
	4.	First-aid measures	
eneral Advice If symptoms persist, call a physician.			
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.		
Skin Contact	Obtain medical attention. Wash off immediately with plenty of water for at least 15 minutes.		
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.		
Ingestion	Clean mouth with water and drink afterwards plenty of water. Get medical attention if symptoms occur.		
Most important symptoms/effects Notes to Physician	None reasonably foreseeable. Treat symptomatically		
	5. Fi	re-fighting measures	
Suitable Extinguishing Media	Use water sp	pray, alcohol-resistant foam, dry chemic	al or carbon dioxide.
Unsuitable Extinguishing Media	a No information available		
Flash Point	No information available		

Method -	No information available
Autoignition Temperature	Not applicable
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous Combustion Products

Carbon monoxide (CO) Carbon dioxide (CO₂)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA Health 1	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental rel	lease measures	
Personal Precautions	Ensure adequate ventilatio	n. Use personal protective equi	ipment. Avoid dust formation.

Lower

Vapor Pressure Vapor Density

Relative Density Solubility

Molecular Formula

Molecular Weight

Viscosity

Partition coefficient; n-octanol/water

Autoignition Temperature

Decomposition temperature

Environmental Precautions	Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.		
Methods for Containment and Clea Up	In Sweep up or vacuum up spillage and collect in suitable container for disposal. Keep in suitable, closed containers for disposal.		
	7. Handling and storage		
Handling	Wear personal protective equipment. Ensure adequate ventilation. Do not get in eyes, on skin, or on clothing. Avoid ingestion and inhalation. Avoid dust formation.		
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place.		
8. E	xposure controls / personal protection		
Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.		
Engineering Measures Personal Protective Equipment	Ensure adequate ventilation, especially in confined areas.		
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.		
Skin and body protection Respiratory Protection	Long sleeved clothing. Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced		
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.		
Q	 Physical and chemical properties 		
Physical State	Solid		
Appearance	Beige		
Odor Threshold	No information available		
nH	No information available		
Melting Point/Range	95 - 101 °C / 203 - 213.8 °F		
Boiling Point/Range	336 °C / 636.8 °F		
Flash Point	No information available		
Evaporation Rate	Not applicable		
Flammability (solid,gas)	No information available		
Flammability or explosive limits	Ne dete evellette		
Upper	NO data available		

10. Stability and reactivity

1.063

No data available

Insoluble in water

No data available

No information available

Not applicable

Not applicable

C14 H10

178.23

1 mmHg @ 116 °C Not applicable

None known, based on information available	
Stable under normal conditions.	
Incompatible products. Excess heat. Avoid dust formation.	
Strong oxidizing agents	
Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO2)	
Hazardous polymerization does not occur.	
None under normal processing.	

11. Toxicological information

Acute Toxicity

Product Information

Component Informa	ation						
Componen	t	LD50 Oral		LD50 Dermal	LC50	Inhalation	
Phenanthrer	ne	1.8 g/kg (Rat)	1.8 g/kg (Rat) Not listed Not listed				
Toxicologically Syn Products	ergistic	No information ava	ailable	d long form over			
Delayed and Immed	late effects as w	vell as chronic effe	cts from short ar	ia long-term expo	sure_		
Irritation		No information ava	ailable				
Sensitization		No information ava	ailable				
Carcinogenicity		The table below in	dicates whether e	ach agency has list	ted any ingredient	as a carcinogen.	
Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico	
Phenanthrene	85-01-8	Not listed	Not listed	Not listed	Not listed	Not listed	
Mutagenic Effects		No information ava	ailable				
Reproductive Effect	ts	No information ava	ailable.				
Developmental Effe	cts	No information ava	ailable.				
Teratogenicity		No information ava	ailable.				
STOT - single expos STOT - repeated exp	e exposure None known ated exposure None known						
Aspiration hazard		No information available					
Symptoms / effects delayed	,both acute and	nd No information available					
Endocrine Disruptor Information No information available							
Other Adverse Effects The toxicological properties have not been fully investigated. See actual entry in R complete information.					ntry in RTECS for		

12. Ecological information

Ecotoxicity Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea

			-			_	
Phenanthrene	No	ot listed	LC50 = 3.2	2 mg/L 96h	Not listed	LC50 = 0.35 mg/L 48h	
Persistence and Degrad	ability	Insoluble in	water May per	rsist			
Bioaccumulation/ Accur	nulation	No informat	ion available				
	nulation						
Mobility		. Is not likely	y mobile in the	environment	due its low water solubil	ity.	
-							
Component					log Pow		
	Phenanthre	ne			4.46		
		10 0	leve e e e le e	and a list and			
		13. D	isposai c	considera	ations		
Waste Disposal Method	S	Chemical w	aste generator	rs must detern	nine whether a discarde	d chemical is classified as a	
		hazardous	waste. Chemic	cal waste gen	erators must also consu	It local, regional, and	
					ccurate classification.		
		14.	Transpor	t informa	ation		
DOT							
UN-No		UN3077					
Proper Shipping Nar	ne	ENVIRONM	IENTALLY HA	LY HAZARDOUS SUBSTANCE, SOLID, N.O.S.			
Hazard Class		9					
Packing Group		111					
<u>TDG</u>							
UN-NO Dropor Shinning No.							
Proper Snipping Nar	ne			ZARDOUS SI	UBSTANCE, SOLID, N.C	0.5.	
Packing Group		UI					
IATA							
UN-No		UN3077					
Proper Shipping Nar	ne	ENVIRON	IENTALLY HA	ZARDOUS SI	UBSTANCE, SOLID, N.	O.S.*	
Hazard Class		9					
Packing Group		III					
IMDG/IMO							
UN-NO Bronor Shinning Nov	m .				UBSTANCE SOUD N	0.8	
Hazard Class	iie				UDSTANCE, SOLID, N.	0.0.	
Packing Group		Ĭ					

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Phenanthrene	Х	Х	-	201-581-5	-		Х	Х	Х	Х	Х

- Legend:
- X Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Phenanthrene	85-01-8	>95	1.0
SARA 311/312 Hazardous Categorization			
Acute Health Hazard	Yes		
Chronic Health Hazard	No		
Fire Hazard	No		
Sudden Release of Pressure Hazard	No		
Reactive Hazard	No		

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Phenanthrene	-	-	Х	Х
Clean Air Act	Not applicable			

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Phenanthrene	5000 lb	-
California Proposition 65	his product doos not contain any Proposition 65 ch	omicolo

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Phenanthrene	Х	Х	Х	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

Non-controlled

	16. Other information
Prepared By	Regulatory Affairs

Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

Creation Date Revision Date Print Date Revision Summary 01-May-2012 11-Aug-2014 11-Aug-2014 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS





Health	3
Fire	2
Reactivity	0
Personal Protection	J

Material Safety Data Sheet Phenol MSDS

Section 1: Chemical Product and Company Identification

Product Name: Phenol

Catalog Codes: SLP4453, SLP5251

CAS#: 108-95-2

RTECS: SJ3325000

TSCA: TSCA 8(b) inventory: Phenol

Cl#: Not available.

Synonym: Monohydroxybenzene; Benzenol; Phenyl hyroxide; Phenylic acid

Chemical Name: Carbolic Acid

Chemical Formula: C6H5OH

Contact Information:

Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396

US Sales: 1-800-901-7247 International Sales: 1-281-441-4400

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Phenol	108-95-2	100

Toxicological Data on Ingredients: Phenol: ORAL (LD50): Acute: 317 mg/kg [Rat]. 270 mg/kg [Mouse]. DERMAL (LD50): Acute: 630 mg/kg [Rabbit]. 669 mg/kg [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:

Very hazardous in case of skin contact (corrosive, irritant), of eye contact (irritant), of ingestion, of inhalation. Hazardous in case of skin contact (sensitizer, permeator). The amount of tissue damage depends on length of contact. Eye contact can result in corneal damage or blindness. Skin contact can produce inflammation and blistering. Inhalation of dust will produce irritation to gastro-intestinal or respiratory tract, characterized by burning, sneezing and coughing. Severe over-exposure can produce lung damage, choking, unconsciousness or death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, central nervous system (CNS). Repeated or prolonged exposure to the substance can produce target organs damage. Repeated exposure of the eyes to a low level of dust can produce eye irritation. Repeated skin exposure can produce local skin destruction, or dermatitis. Repeated inhalation of dust can produce varying degree of respiratory irritation or lung damage. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:

In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:

Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:

Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: May be combustible at high temperature.

Auto-Ignition Temperature: 715°C (1319°F)

Flash Points: CLOSED CUP: 79°C (174.2°F). OPEN CUP: 85°C (185°F).

Flammable Limits: LOWER: 1.7% UPPER: 8.6%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances:

Flammable in presence of open flames and sparks, of heat. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

Special Remarks on Fire Hazards:

Phenol + nitrides results in heat and flammable gas generation. Phenol + mineral oxdizing acids results in fire. Phenol + calcium hypochlorite is an exothermic reaction producing toxic fumes which may ignite.
Phenol + sodium nitrite causes explosion on heating. Peroxydisulfuric acid + phenol causes explosion.

Section 6: Accidental Release Measures

Small Spill: Use appropriate tools to put the spilled solid in a convenient waste disposal container.

Large Spill:

Corrosive solid. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:

Keep locked up.. Keep container dry. Keep away from heat. Keep away from sources of ignition. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not ingest. Do not breathe dust. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, acids.

Storage:

Air Sensitive. Sensitive to light. Store in light-resistant containers. Moisture sensitive. Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection:

Splash goggles. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Vapor and dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:

TWA: 5 (ppm) from ACGIH (TLV) [United States] SKIN TWA: 19 (mg/m3) from ACGIH (TLV) [United States] SKIN TWA: 5 from NIOSH [United States] TWA: 19 (mg/m3) from NIOSH [United States] TWA: 5 (ppm) from OSHA (PEL) [United States] TWA: 19 (mg/m3) from OSHA (PEL) [United States] TWA: 5 (ppm) [Canada] TWA: 19 (mg/m3) [Canada]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor:

Distinct, aromatic, somewhat sickening sweet and acrid

Taste: Burning.

Molecular Weight: 94.11 g/mole

Color: Colorless to light pink

pH (1% soln/water): Not available.

Boiling Point: 182°C (359.6°F)

Melting Point: 42°C (107.6°F)

Critical Temperature: 694.2 (1281.6°F)

Specific Gravity: 1.057 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: 3.24 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.048 ppm

Water/Oil Dist. Coeff.: The product is more soluble in oil; log(oil/water) = 1.5

lonicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether, acetone.

Solubility:

Easily soluble in methanol, diethyl ether. Soluble in cold water, acetone. Solubility in water: 1g/15 ml water. Soluble in benzene. Very soluble in alcohol, chloroform, glycerol, petroleum, carbon disulfide, volatile and fixed oils, aqueous alkali hydroxides, carbon tetrachloride, acetic acid, liquid sulfur dioxide. Almost insoluble in petroleum ether. Miscible in acetone. Sparingly soluble in mineral oil.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Heat, ignition sources (flames, sparks), light, incompatible materials

Incompatibility with various substances: Reactive with oxidizing agents, metals, acids, alkalis.

Corrosivity:

Extremely corrosive in presence of copper. Slightly corrosive in presence of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass, of aluminum.

Special Remarks on Reactivity:

Air and light sensitive. Prone to redden on exposure to light and air. Incompatible with aluminum chloride, peroxydisulfuirc acid, acetaldehyde, sodium nitrite, boron trifluoride diethyl ether + 1,3-butadiene, isocyanates, nitrides, mineral oxidizing acids, calcium hypochlorite, halogens, formaldehyde, metals and alloys, lead, zinc, magnesium and their alloys, plastics, rubber, coatings, sodium nitrate + trifluoroacetic acid. Phenol + isocyanates results in heat generation, and violent polymerization. Phenol + 1,3-butadiene and boron trifluoride diethyl ether complex results in intense exothermic reaction. Phenol + acetaldehyde resultes in violent condensation.

Special Remarks on Corrosivity:

Minor corrosive effect on bronze. Severe corrosive effect on brass.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:

Acute oral toxicity (LD50): 270 mg/kg [Mouse]. Acute dermal toxicity (LD50): 630 mg/kg [Rabbit].

Chronic Effects on Humans:

CARCINOGENIC EFFECTS: A4 (Not classifiable for human or animal.) by ACGIH, 3 (Not classifiable for human.) by IARC. MUTAGENIC EFFECTS: Mutagenic for mammalian somatic cells. Mutagenic for bacteria and/or yeast. May cause damage to the following organs: kidneys, liver, central nervous system (CNS).

Other Toxic Effects on Humans:

Very hazardous in case of skin contact (corrosive, irritant), of ingestion, . Hazardous in case of skin contact (sensitizer, permeator), of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:

Lowest Published Lethal Dose: LDL [Human] - Route: Oral; Dose: 140 mg/kg LDL [Infant] - Route: Oral; Dose: 10,000 mg/kg

Special Remarks on Chronic Effects on Humans:

Animal: passes through the placental barrier. May cause adverse reproductive effects and birth defects (teratogenic) Embryotoxic and/or foetotoxic in animal. May affect genetic material (mutagenic).

Special Remarks on other Toxic Effects on Humans:

Section 12: Ecological Information

Ecotoxicity:

Ecotoxicity in water (LC50): 125 mg/l 24 hours [Fish (Goldfish)]. >50 mg/l 1 hours [Fish (Fathead minnow)]. >50 mg/l 24 hours [Fish (Fathead minnow)]. >33 mg/l 72 hours [Fish (Fathead minnow)]. >33 ppm 96 hours [Fish (Fathead minnow)].

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: CLASS 6.1: Poisonous material.

Identification: : Phenol, solid UNNA: 1671 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:

Connecticut hazardous material survey.: Phenol Illinois toxic substances disclosure to employee act: Phenol Illinois chemical safety act: Phenol New York release reporting list: Phenol Rhode Island RTK hazardous substances: Phenol Pennsylvania RTK: Phenol Minnesota: Phenol Massachusetts RTK: Phenol Massachusetts spill list: Phenol New Jersey: Phenol New Jersey spill list: Phenol Louisiana RTK reporting list: Phenol Louisiana spill reporting: Phenol TSCA 8(b) inventory: Phenol TSCA 4(a) proposed test rules: Phenol TSCA 8(a) IUR: Phenol TSCA 8(d) H and S data reporting: Phenol: effective: 6/1/87; sunset:

6/01/97 SARA 302/304/311/312 extremely hazardous substances: Phenol SARA 313 toxic chemical notification and release reporting: Phenol CERCLA: Hazardous substances.: Phenol: 1000 lbs. (453.6 kg)

Other Regulations:

OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):

CLASS D-1A: Material causing immediate and serious toxic effects (VERY TOXIC). CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive solid.

DSCL (EEC):

R24/25- Toxic in contact with skin and if swallowed. R34- Causes burns. R40- Possible risks of irreversible effects. R43-May cause sensitization by skin contact. R52- Harmful to aquatic organisms. S1/2- Keep locked up and out of the reach of children. S24- Avoid contact with skin. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S28- After contact with skin, wash immediately with plenty of water S37/39- Wear suitable gloves and eye/face protection. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). S46- If swallowed, seek medical advice immediately and show this container or label. S56- Dispose of this material and its container at hazardous or special waste collection point.

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 2

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 4

Flammability: 2

Reactivity: 0

Specific hazard:

Protective Equipment:

Gloves. Synthetic apron. Vapor and dust respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 11:17 AM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Version 3.10 Revision Date 03/03/2015 Print Date 02/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Potassium	
	Product Number Brand	:	244864 Aldrich	
	CAS-No.	:	7440-09-7	
1.2 Relevant identified uses of the substance or mixture and uses		e substance or mixture and uses advised against		
	Identified uses	:	Laboratory chemicals, Manufacture of substances	
1.3	Details of the supplier of the safety data sheet			
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA	
	Telephone	•	+1 800-325-5832	

:

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

Fax

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260 Skin corrosion (Category 1A), H314 Serious eye damage (Category 1), H318 Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

+1 800-325-5052

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H260	In contact with water releases flammable gases which may ignite spontaneously.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H350	May cause cancer.
Precautionary statement(s)
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire.

Handle under inert gas. Protect from moisture.
Do not breathe dust or mist.
Wash skin thoroughly after handling.
Wear protective gloves/ protective clothing/ eye protection/ face protection.
Use personal protective equipment as required.
IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.
IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Immediately call a POISON CENTER or doctor/ physician.
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
IF exposed or concerned: Get medical advice/ attention.
Brush off loose particles from skin. Immerse in cool water/ wrap in wet bandages.
Wash contaminated clothing before reuse.
In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Store in a dry place. Store in a closed container. Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

Reacts violently with water.

May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 Mixtures

Formula	:	К
Molecular weight	:	39.10 g/mol

Hazardous components

Component		Classification	Concentration	
Potassium				
CAS-No.	7440-09-7	Water-react. 1; Skin Corr. 1A;	>= 90 - <= 100	
EC-No.	231-119-8	Eye Dam. 1; H260, H314	%	
Index-No.	019-001-00-2			
Paraffin oils				
CAS-No.	8012-95-1	Carc. 1A; H350	>= 1 - < 5 %	
EC-No.	232-384-2			
For the full text of the I	H-Statements mentioned in	this Section, see Section 16.		

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Dry powder

- 5.2 Special hazards arising from the substance or mixture Carbon oxides, Potassium oxides
- **5.3** Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.
- 5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

- 6.3 Methods and materials for containment and cleaning up Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wetbrushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.
- 6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Never allow product to get in contact with water during storage.

Handle and store under inert gas.

Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
Paraffin oils	8012-95-1	STEL	10.000000	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
		TWA	5.000000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
				Contaminants
		TWA	5.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		ST	10.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		TWA	5.000000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
			-	Contaminants
		TWA	5.000000	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
	Remarks	Upper Respi	ratory Tract irritation	on
		2014 Adoptio	on	
		Not classifial	ble as a human ca	rcinogen
		Upper Respiratory Tract irritation		
		2014 Adoptio	on	
		Exposure by all routes should be carefully controlled to levels as lo		
		as possible.		
		Suspected human carcinogen		
		TWA	5.000000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
				Contaminants
		TWA	5.000000	USA. Occupational Exposure Limits
			mg/m3	(OSHA) - Table Z-1 Limits for Air
				Contaminants
		Upper Respi	ratory Tract irritation	on
		Exposure by	all routes should b	be carefully controlled to levels as low
		as possible.		
		Suspected h	uman carcinogen	
		TWA	5.000000	USA. ACGIH Threshold Limit Values
			mg/m3	(TLV)
		Upper Respi	ratory Tract irritation	on
		Not classifial	ole as a human ca	rcinogen
		TWA	5.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		ST	10.000000	USA. NIOSH Recommended
			mg/m3	Exposure Limits
		Upper Respiratory Tract irritation		on
		Exposure by all routes should be carefully controlled to levels as low		be carefully controlled to levels as low
		as possible.		
		Suspected h	uman carcinogen	

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Fragments Colour: grey
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 64 °C (147 °F)
f)	Initial boiling point and boiling range	774 °C (1,425 °F) at 1,013 hPa (760 mmHg)
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower	No data available

flammability or explosive limits

- k) Vapour pressure 0.12 hPa (0.09 mmHg) at 260 °C (500 °F)
- I) Vapour density No data available
- m) Relative density 0.860 g/cm3
- n) Water solubility No data available
- o) Partition coefficient: n- No data available octanol/water
- p) Auto-ignition No data available temperature
- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available

9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Reacts violently with water.
- **10.4** Conditions to avoid Exposure to moisture
- **10.5** Incompatible materials Oxidizing agents, Strong oxidizing agents, Carbon oxides, Reacts violently with water., Reacts with water to generate Hydrogen gas.
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

No data available

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

IARC: 1 - Group 1: Carcinogenic to humans (Paraffin oils)

- NTP: Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Paraffin oils)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard

No data available

Additional Information

RTECS: Not available

Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2257 Class: 4.3 Proper shipping name: Potassium Reportable Quantity (RQ): Packing group: I

Poison Inhalation Hazard: No				
IMDG UN number: 2257 CI Proper shipping name: PC	lass: 4.3 DTASSIUM	Packing group: I	EMS-No: F-G, S-N	
IATA UN number: 2257 CI Proper shipping name: Po IATA Passenger: Not perm	lass: 4.3 stassium nitted for transport	Packing group: I		

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

~ . ~ . .

. .

SARA 311/312 Hazards

Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Potassium	7440-09-7	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Potassium	7440-09-7	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Potassium	7440-09-7	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Paraffin oils	8012-95-1	1987-02-27

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

3

Carc.	Carcinogenicity
Eye Dam.	Serious eye damage
H260	In contact with water releases flammable gases which may ignite spontaneously.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H350	May cause cancer.
Skin Corr.	Skin corrosion
Water-react.	Substances and mixtures, which in contact with water, emit flammable gases
HMIS Rating	

Health hazard:

Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	2
NFPA Rating	
Health hazard:	3
Fire Hazard:	4
Reactivity Hazard:	2
Special hazard.I:	W

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.10

Revision Date: 03/03/2015

Print Date: 02/07/2016

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



date of compilation: 11.05.2015 Revision: 11.04.2019

p-Xylene ≥99 %, for synthesis

article number: **8817** Version: **3.0 en** Replaces version of: 04.07.2016 Version: (2)

SECTION 1: Identification of the substance/mixture and of the company/ undertaking

1.1	Product identifier				
	Identification of the substance	p-Xylene			
	Article number	8817			
	Registration number (REACH)	It is not required to list the identified uses be- cause the substance is not subject to registration according to REACH (< 1 t/a)			
	Index No	601-022-00-9			
	EC number	203-396-5			
	CAS number	106-42-3			
1.2	Relevant identified uses of the substance or mix	cture and uses advised against			
	Identified uses:	laboratory chemical laboratory and analytical use			
1.3	Details of the supplier of the safety data sheet Carl Roth GmbH + Co KG Schoemperlenstr. 3-5 D-76185 Karlsruhe Germany Telephone: +49 (0) 721 - 56 06 0 Telefax: +49 (0) 721 - 56 06 149 e-mail: sicherheit@carlroth.de Website: www.carlroth.de Competent person responsible for the safety data sheet e-mail (competent person)	: Department Health, Safety and Environment			
1.4	Emergency telephone number				
	Emergency information service	Poison Centre Munich: +49/(0)89 19240			
SEC	TION 2: Hazards identification				
SEC	TION 2. Hazarus identification				
2.1	Classification of the substance or mixture				
	Classification according to Regulation (EC) No 1272/2008 (CLP)				
	Classification ass to CHS				

Section	Hazard class	Hazard class and cat- egory	Hazard state- ment			
2.6	flammable liquid	(Flam. Liq. 3)	H226			
3.1D	acute toxicity (dermal)	(Acute Tox. 4)	H312			
3.1I	acute toxicity (inhal.)	(Acute Tox. 4)	H332			
3.2	skin corrosion/irritation	(Skin Irrit. 2)	H315			

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



p-Xylene ≥99 %, for synthesis

article number: 8817

Classification acc. to GHS							
Section	Hazard class	Hazard class and cat- egory	Hazard state- ment				
3.3	serious eye damage/eye irritation	(Eye Irrit. 2)	H319				
3.8R	specific target organ toxicity - single exposure (respiratory tract ir- ritation)	(STOT SE 3)	H335				
3.10	aspiration hazard	(Asp. Tox. 1)	H304				

2.2 Label elements

Signal word

Labelling according to Regulation (EC) No 1272/2008 (CLP)

	-
Pictograms	
GHS02, GHS07, GHS08	

Danger

Hazard statements

H226 H304 H312+H332	Flammable liquid and vapour May be fatal if swallowed and enters airways Harmful in contact with skin or if inhaled
H315	Causes skin irritation
H319	Causes serious eye irritation
H335	May cause respiratory irritation

Precautionary statements

Precautionary statements - prevention

P210	Keep away from heat, hot surfaces, sparks, open flames and other ignition
	sources. No smoking.
P280	Wear protective gloves/protective clothing/eye protection/face protection.

Precautionary statements - response

P301+P310 P302+P352 P304+P340	IF SWALLOWED: Immediately call a doctor. IF ON SKIN: Wash with plenty of water/
P304+P340 P331	Do NOT induce vomiting.

Labelling of packages where the contents do not exceed 125 ml

Signal word: Danger

Symbol(s)



H304 P301+P310

P331

May be fatal if swallowed and enters airways.

P310 IF SWALL Do NOT i

IF SWALLOWED: Immediately call a doctor. Do NOT induce vomiting.

2.3 Other hazards

There is no additional information.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



p-Xylene ≥99 %, for synthesis

article number: 8817

3.1

SECTION 3: Composition/information on ingredients

Substances	
Name of substance	1,4-Dimethylbenzene
Index No	601-022-00-9
EC number	203-396-5
CAS number	106-42-3
Molecular formula	C ₈ H ₁₀
Molar mass	106,2 ^g / _{mol}

SECTION 4: First aid measures

4.1 Description of first aid measures



General notes

Take off contaminated clothing.

Following inhalation

Provide fresh air. In all cases of doubt, or when symptoms persist, seek medical advice.

Following skin contact

Rinse skin with water/shower. In case of skin irritation, consult a physician.

Following eye contact

Irrigate copiously with clean, fresh water for at least 10 minutes, holding the eyelids apart. In case of eye irritation consult an ophthalmologist.

Following ingestion

Rinse mouth immediately and drink plenty of water. Observe aspiration hazard if vomiting occurs. Call a physician immediately.

4.2 Most important symptoms and effects, both acute and delayed

Irritant effects. Vertigo. Dizziness. Unconsciousness. Aspiration hazard. Headache. Cough. Breathing difficulties. Nausea. Vomiting.

4.3 Indication of any immediate medical attention and special treatment needed

none

SECTION 5: Firefighting measures

5.1 Extinguishing media



Suitable extinguishing media

Co-ordinate fire-fighting measures to the fire surroundings

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



p-Xylene ≥99 %, for synthesis

article number: 8817

water spray, foam, dry extinguishing powder, carbon dioxide (CO2)

Unsuitable extinguishing media

water jet

5.2 Special hazards arising from the substance or mixture

Combustible. Vapours can form explosive mixtures with air.

Hazardous combustion products

In case of fire may be liberated: carbon monoxide (CO), carbon dioxide (CO2)

5.3 Advice for firefighters

Vapours are heavier than air. Beware of reignition. Fight fire with normal precautions from a reasonable distance. Wear self-contained breathing apparatus.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures



For non-emergency personnel

Use personal protective equipment as required. Avoid contact with skin, eyes and clothes. Do not breathe vapour/spray. Avoidance of ignition sources.

6.2 Environmental precautions

Keep away from drains, surface and ground water. Explosive properties.

6.3 Methods and material for containment and cleaning up

Advices on how to contain a spill

Covering of drains.

Advices on how to clean up a spill

Absorb with liquid-binding material (e.g. sand, diatomaceous earth, acid- or universal binding agents).

Other information relating to spills and releases

Place in appropriate containers for disposal. Ventilate affected area.

6.4 Reference to other sections

Hazardous combustion products: see section 5. Personal protective equipment: see section 8. Incompatible materials: see section 10. Disposal considerations: see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Provide adequate ventilation as well as local exhaustion at critical locations. Avoid exposure. When not in use, keep containers tightly closed.

• Measures to prevent fire as well as aerosol and dust generation



Keep away from sources of ignition - No smoking.

Take precautionary measures against static discharge.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Advice on general occupational hygiene

Wash hands before breaks and after work. Keep away from food, drink and animal feedingstuffs. When using do not smoke.

7.2 Conditions for safe storage, including any incompatibilities

Store in a well-ventilated place. Keep container tightly closed. Protect from sunlight.

Incompatible substances or mixtures

Observe hints for combined storage.

Consideration of other advice

Ground/bond container and receiving equipment.

• Ventilation requirements

Use local and general ventilation.

• Specific designs for storage rooms or vessels

Recommended storage temperature: 15 – 25 °C.

7.3 Specific end use(s)

No information available.

SECTION 8: Exposure controls/personal protection

8.1 Control parameters

National limit values

Occupational exposure limit values (Workplace Exposure Limits)

Coun- try	Name of agent	CAS No	Identifier	TWA [ppm]	TWA [mg/ m³]	STEL [ppm]	STEL [mg/ m³]	Source
EU	p-xylene	106-42-3	IOELV	50	221	100	442	2000/39/EC
MT	p-xylene	106-42-3	OELV	50	221	100	442	CAP. 424

Notation

STEL TWA Short-term exposure limit: a limit value above which exposure should not occur and which is related to a 15minute period (unless otherwise specified)

Time-weighted average (long-term exposure limit): measured or calculated in relation to a reference period of 8 hours time-weighted average (unless otherwise specified)

Relevant DNELs/DMELs/PNECs and other threshold levels

• human health values

Endpoint	Threshold level	Protection goal, Used in route of exposure		Exposure time
DNEL	221 mg/m³	human, inhalatory	worker (industry)	chronic - systemic effects
DNEL	442 mg/m ³	human, inhalatory	worker (industry)	acute - systemic effects
DNEL	221 mg/m ³	human, inhalatory	worker (industry)	chronic - local effects
DNEL	442 mg/m ³	human, inhalatory	worker (industry)	acute - local effects
DNEL	212 mg/kg bw/ day	human, dermal	worker (industry)	chronic - systemic effects

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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environmental values						
Endpoint	Threshold level	Environmental compartment	Exposure time			
PNEC	0,25 ^{mg} / _l	water	intermittent release			
PNEC	0,044 ^{mg} / _l	freshwater	short-term (single instance)			
PNEC	0,004 ^{mg} / _l	marine water	short-term (single instance)			
PNEC	1,6 ^{mg} / _l	sewage treatment plant (STP)	short-term (single instance)			
PNEC	2,52 ^{mg} / _{kg}	freshwater sediment	short-term (single instance)			
PNEC	0,252 ^{mg} / _{kg}	marine sediment	short-term (single instance)			
PNEC	0,852 ^{mg} / _{kg}	soil	short-term (single instance)			

8.2 Exposure controls

Individual protection measures (personal protective equipment)

Eye/face protection



Use safety goggle with side protection.

Skin protection



hand protection

Wear suitable gloves. Chemical protection gloves are suitable, which are tested according to EN 374. For special purposes, it is recommended to check the resistance to chemicals of the protective gloves mentioned above together with the supplier of these gloves.

• type of material

FKM (fluoro rubber)

material thickness

0,4 mm.

• breakthrough times of the glove material

>480 minutes (permeation: level 6)

other protection measures

Take recovery periods for skin regeneration. Preventive skin protection (barrier creams/ointments) is recommended.

Respiratory protection



Respiratory protection necessary at: Aerosol or mist formation. Type: A (against organic gases and vapours with a boiling point of > 65 $^{\circ}$ C, colour code: Brown).

Environmental exposure controls

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Keep away from drains, surface and ground water.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

Appearance	
Physical state	liquid (fluid)
Colour	colourless
Odour	characteristic
Odour threshold	No data available
Other physical and chemical parameters	
pH (value)	This information is not available.
Melting point/freezing point	13,25 °C at 1.013 hPa
Initial boiling point and boiling range	138,2 °C at 1.013 hPa
Flash point	27 °C at 1.013 hPa
Evaporation rate	no data available
Flammability (solid, gas)	not relevant (fluid)
Explosive limits	
 lower explosion limit (LEL) 	0,9 vol%
• upper explosion limit (UEL)	7 vol%
Explosion limits of dust clouds	not relevant
Vapour pressure	8,7 hPa at 20 °C
Density	0,86 ^g / _{cm³} at 25 °C
Vapour density	This information is not available.
Bulk density	Not applicable
Relative density	Information on this property is not available.
Solubility(ies)	
Water solubility	170,5 ^{mg} / _l at 25 °C
Partition coefficient	
n-octanol/water (log KOW)	3,15 (pH value: 7, 20 °C) (ECHA)
Soil organic carbon/water (log KOC)	2,73 (ECHA)
Auto-ignition temperature	528 °C at 1.013 hPa - ECHA
Decomposition temperature	no data available
Viscosity	
• kinematic viscosity	0,7012 ^{mm²} / _s
• dynamic viscosity	0,603 mPa s at 25 °C
Explosive properties	Shall not be classified as explosive

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Oxidising properties

9.2 Other information

Surface tension

Temperature class (EU, acc. to ATEX)

none

28,01 ^{mN}/_m (25 °C)

T1 (Maximum permissible surface temperature on the equipment: 450°C)

SECTION 10: Stability and reactivity

10.1 Reactivity

Risk of ignition. In case of warming: Vapours can form explosive mixtures with air.

10.2 Chemical stability

The material is stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

10.3 Possibility of hazardous reactions

Violent reaction with: Oxidisers, Nitric acid, Sulphuric acid, Sulphur

10.4 Conditions to avoid

Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

10.5 Incompatible materials

Rubber articles, different plastics

10.6 Hazardous decomposition products

Hazardous combustion products: see section 5.

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Exposure route	Endpoint	Value	Species	Source
inhalation: vapour	LC50	19,8 ^{mg} / _l /4h	rat	GESTIS
oral	LD50	3.523 ^{mg} / _{kg}	rat	ECHA
dermal	LD50	12.126 ^{mg} / _{kg}	rabbit	ECHA

Skin corrosion/irritation

Causes skin irritation.

Serious eye damage/eye irritation

Causes serious eye irritation.

Respiratory or skin sensitisation

Shall not be classified as a respiratory or skin sensitiser.

Summary of evaluation of the CMR properties

Shall not be classified as germ cell mutagenic, carcinogenic nor as a reproductive toxicant

• Specific target organ toxicity - single exposure

May cause respiratory irritation.

• Specific target organ toxicity - repeated exposure

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Shall not be classified as a specific target organ toxicant (repeated exposure).

Aspiration hazard

May be fatal if swallowed and enters airways.

Symptoms related to the physical, chemical and toxicological characteristics

• If swallowed

vomiting, aspiration hazard

• If in eyes

Causes serious eye irritation

• If inhaled

irritant effects, cough, breathing difficulties, pulmonary oedema

• If on skin

causes skin irritation, risk of absorption via the skin

Other information

Other adverse effects: Headache, Vertigo, Dizziness, Nausea, Unconsciousness, Liver and kidney damage, Symptoms can occur only after several hours

SECTION 12: Ecological information

12.1 Toxicity

acc. to 1272/2008/EC: Shall not be classified as hazardous to the aquatic environment.

Aquatic toxicity (acute)

Endpoint	Value	Species	Source	Exposure time
LC50	2,6 ^{mg} / _l	fish	ECHA	96 h
ErC50	4,7 ^{mg} / _l	algae	ECHA	72 h

Aquatic toxicity (chronic)

Endpoint	Value	Species	Source	Exposure time
EC50	2,2 ^{mg} / _l	algae	ECHA	73 h
NOEC	1,57 ^{mg} / _l	aquatic invertebrates	ECHA	21 d
NOEC	0,44 ^{mg} / _l	algae	ECHA	73 h
growth rate (ErCx) 10%	1,9 ^{mg} / _l	algae	ECHA	73 h

12.2 Process of degradability

The substance is readily biodegradable. Theoretical Oxygen Demand: 3,165 ^{mg}/_{mg} Theoretical Carbon Dioxide: 3,316 ^{mg}/_{mg}

Process	Degradation rate	Time
carbon dioxide generation	50 %	13 d
oxygen depletion	90 %	28 d

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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12.3	Bioaccumulative potential	
	Does not significantly accumulate in organisms.	
	n-octanol/water (log KOW)	3,15 (pH value: 7, 20 °C)
	BCF	>5,5 – <12,2 (ECHA)
12.4	Mobility in soil	
	Henry's law constant	623 ^{Pa m³} / _{mol} at 25 °C
	The Organic Carbon normalised adsorption coefficient	2,73
12.5	Results of PBT and vPvB assessment	

Data are not available.

12.6 Other adverse effects

Data are not available.

SECTION 13: Disposal considerations

13.1 Waste treatment methods



This material and its container must be disposed of as hazardous waste. Dispose of contents/container in accordance with local/regional/national/international regulations.

Sewage disposal-relevant information

Do not empty into drains.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

Sewage disposal-relevant information

Do not empty into drains.

Waste treatment of containers/packagings

It is a dangerous waste; only packagings which are approved (e.g. acc. to ADR) may be used.

13.2 Relevant provisions relating to waste

The allocation of waste identity numbers/waste descriptions must be carried out according to the EEC, specific to the industry and process.

13.3 Remarks

Waste shall be separated into the categories that can be handled separately by the local or national waste management facilities. Please consider the relevant national or regional provisions.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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SEC	TION 14: Transport information	
14.1	UN number	1307
14.2	UN proper shipping name	XYLENES
	Hazardous ingredients	p-Xylene
14.3	Transport hazard class(es)	
	Class	3 (flammable liquids)
14.4	Packing group	III (substance presenting low danger)
14.5	Environmental hazards	NONE (non-environmentally hazardous acc. to the danger- ous goods regulations)
14.6	Special precautions for user	
	Provisions for dangerous goods (ADR) should be o	omplied within the premises.
14.7	Transport in bulk according to Annex II of MAR The cargo is not intended to be carried in bulk.	POL and the IBC Code
14.8	Information for each of the UN Model Regulati	ons
	• Transport of dangerous goods by road, rail an	d inland waterway (ADR/RID/ADN)
	UN number	1307
	Proper shipping name	XYLENES
	Particulars in the transport document	UN1307, XYLENES, 3, III, (D/E)
	Class	3
	Classification code	F1
	Packing group	III
	Danger label(s)	3
	Excepted quantities (EQ)	E1
	Limited quantities (LQ)	5 L
	Transport category (TC)	3
	Tunnel restriction code (TRC)	D/E
	Hazard identification No	30
	• International Maritime Dangerous Goods Cod	e (IMDG)
	UN number	1307
	Proper shipping name	XYLENES
	Particulars in the shipper's declaration	UN1307, XYLENES, 3, III, 27°C c.c.
	Class	3

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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arti	ticle number: 8817		
	Marine pollutant	-	
	Packing group	III	
	Danger label(s)	3	
	Special provisions (SP)	223	
	Excepted quantities (EQ)	E1	
	Limited quantities (LQ)	5 L	
	EmS	F-E, S-D	
	Stowage category	A	
	 International Civil Aviation Organization 	(ICAO-IATA/DGR)	
	UN number	1307	
	Proper shipping name	Xylenes	
	Particulars in the shipper's declaration	UN1307, Xylenes, 3, III	
	Class	3	
	Packing group	III	
	Danger label(s)	3	
	Special provisions (SP)	A3	
	Excepted quantities (EQ)	E1	
	Limited quantities (LQ)	10 L	

SECTION 15: Regulatory information

15.1 Safety, health and environmental regulations/legislation specific for the substance or mixture Relevant provisions of the European Union (EU)

• **Regulation 649/2012/EU concerning the export and import of hazardous chemicals (PIC)** Not listed.

• **Regulation 1005/2009/EC on substances that deplete the ozone layer (ODS)** Not listed.

• **Regulation 850/2004/EC on persistent organic pollutants (POP)** Not listed.

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Restrictions according to REACH, Annex XVII

Name of substance	CAS No	Wt%	Type of registration	Conditions of restric- tion	Νο
p-Xylene		100	1907/2006/EC annex XVII	R3	3
p-Xylene		100	1907/2006/EC annex XVII	R40	40

Legend R3

1. Shall not be used in:

- ornamental articles intended to produce light or colour effects by means of different phases, for example in ornamental lamps and ashtrays,

- tricks and jokes,

games for one or more participants, or any article intended to be used as such, even with ornamental aspects,
2. Articles not complying with paragraph 1 shall not be placed on the market.
3. Shall not be placed on the market if they contain a colouring agent, unless required for fiscal reasons, or perfume, or both, if they:

- can be used as fuel in decorative oil lamps for supply to the general public, and,
 - present an aspiration hazard and are labelled with R65 or H304,

Decorative oil lamps for supply to the general public shall not be placed on the market unless they conform to the European Standard on Decorative oil lamps (EN 14059) adopted by the European Committee for Standardisa-

tion (CEN). 5. Without prejudice to the implementation of other Community provisions relating to the classification, pack-aging and labelling of dangerous substances and mixtures, suppliers shall ensure, before the placing on the market, that the following requirements are met:

ket, that the following requirements are met:
(a) lamp oils, labelled with R65 or H304, intended for supply to the general public are visibly, legibly and indelibly marked as follows: 'Keep lamps filled with this liquid out of the reach of children'; and, by 1 December 2010, 'Just a sip of lamp oil - or even sucking the wick of lamps - may lead to life-threatening lung damage';
(b) grill lighter fluids, labelled with R65 or H304, intended for supply to the general public are legibly and indelibly marked by 1 December 2010 as follows: 'Just a sip of grill lighter may lead to life threatening lung damage';
(c) lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are legibly and indelibly marked by 1 December 2010 as follows: 'Just a sip of grill lighter may lead to life threatening lung damage';
(c) lamp oils and grill lighters, labelled with R65 or H304, intended for supply to the general public are packaged in black opaque containers not exceeding 1 litre by 1 December 2010.
6. No later than 1 June 2014, the Commission shall request the European Chemicals Agency to prepare a dossier, in accordance with Article 69 of the present Regulation with a view to ban, if appropriate, grill lighter fluids and fuel for decorative lamps, labelled R65 or H304, intended for supply to the general public.
7. Natural or legal persons placing on the market for the first time lamp oils and grill lighter fluids, labelled with R65 or H304, shall by 1 December 2011, and annually thereafter, provide data on alternatives to lamp oils and grill lighter fluids labelled R65 or H304 to the competent authority in the Member State concerned. Member States shall make those data available to the Commission. shall make those data available to the Commission.

1. Shall not be used, as substance or as mixtures in aerosol dispensers where these aerosol dispensers are intended for supply to the general public for entertainment and decorative purposes such as the following: - metallic glitter intended mainly for decoration,

- artificial snow and frost,
 'whoopee' cushions,
- silly string aerosols
- imitation excrement,
- horns for parties,
- decorative flakes and foams,

- artificial cobwebs

- stink bombs.

2. Without prejudice to the application of other Community provisions on the classification, packaging and labelling of substances, suppliers shall ensure before the placing on the market that the packaging of aerosol dis-pensers referred to above is marked visibly, legibly and indelibly with: 'For professional users only'.

3. By way of derogation, paragraphs 1 and 2 shall not apply to the aerosol dispensers referred to Article 8 (1a) of Council Directive 75/324/EEC (2).

4. The aerosol dispensers referred to in paragraphs 1 and 2 shall not be placed on the market unless they conform to the requirements indicated.

Restrictions according to REACH, Title VIII

None.

R40

List of substances subject to authorisation (REACH, Annex XIV)/SVHC - candidate list

not listed

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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• Seveso Directive				
2012/18/EU (Seveso III)				
Νο	Dangerous substance/hazard categories	Qualifying quantity plication of lower quire	(tonnes) for the ap- and upper-tier re- ments	Notes
P5c	flammable liquids (cat. 2, 3)	5.000	50.000	51)

Notation

51) Flammable liquids, categories 2 or 3 not covered by P5a and P5b

• Directive 75/324/EEC relating to aerosol dispensers

Filling batch

Deco-Paint Directive (2004/42/EC)

VOC content	100 % 860 ^g /l	
Directive on industrial emissions (VOCs, 2010/75/EU)		
VOC content	100 %	
VOC content	860 ^g / _l	

Directive 2011/65/EU on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS) - Annex II

not listed

Regulation 166/2006/EC concerning the establishment of a European Pollutant Release and Transfer Register (PRTR)

not listed

Directive 2000/60/EC establishing a framework for Community action in the field of water policy (WFD)

not listed

Regulation 98/2013/EU on the marketing and use of explosives precursors

not listed

Regulation 111/2005/EC laying down rules for the monitoring of trade between the Community and third countries in drug precursors

not listed

National inventories

Substance is listed in the following national inventories:

Country	National inventories	Status
AU	AICS	substance is listed
CA	DSL	substance is listed
CN	IECSC	substance is listed
EU	ECSI	substance is listed
EU	REACH Reg.	substance is listed
JP	CSCL-ENCS	substance is listed

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Country	National inventories	Status
JP	ISHA-ENCS	substance is listed
KR	KECI	substance is listed
MX	INSQ	substance is listed
NZ	NZIoC	substance is listed
PH	PICCS	substance is listed
TR	CICR	substance is listed
TW	TCSI	substance is listed
US	TSCA	substance is listed

Legend

AICS	Australian Inventory of Chemical Substances
CSCL-ENCS	List of Existing and New Chemical Substances (CSCL-ENCS)
DSL FCSI	Domestic Substances List (DSL) EC Substance Inventory (EINECS, ELINCS, NLP)
IECSC	Inventory of Existing Chemical Substances Produced or Imported in China
	National Inventory of Chemical Substances
KECI	Korea Existing Chemicals Inventory
NZIOC	New Zealand Inventory of Chemicals
REACH Reg.	REACH registered substances
	Taiwan Chemical Substance Inventory
IJCA	

15.2 Chemical Safety Assessment

No Chemical Safety Assessment has been carried out for this substance.

SECTION 16: Other information

Abbreviations and acronyms

Abbr.	Descriptions of used abbreviations
2000/39/EC	Commission Directive establishing a first list of indicative occupational exposure limit values in implementa- tion of Council Directive 98/24/EC
ADN	Accord européen relatif au transport international des marchandises dangereuses par voies de navigation intérieures (European Agreement concerning the International Carriage of Dangerous Goods by Inland Waterways)
ADR	Accord européen relatif au transport international des marchandises dangereuses par route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
BCF	bioconcentration factor
CAP. 424	Occupational Health and Safety Authority Act (CAP. 424)
CAS	Chemical Abstracts Service (service that maintains the most comprehensive list of chemical substances)
CLP	Regulation (EC) No 1272/2008 on classification, labelling and packaging of substances and mixtures
CMR	Carcinogenic, Mutagenic or toxic for Reproduction
DGR	Dangerous Goods Regulations (see IATA/DGR)
DMEL	Derived Minimal Effect Level
DNEL	Derived No-Effect Level
EINECS	European Inventory of Existing Commercial Chemical Substances
ELINCS	European List of Notified Chemical Substances

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU

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Abbr.	Descriptions of used abbreviations
EmS	Emergency Schedule
GHS	"Globally Harmonized System of Classification and Labelling of Chemicals" developed by the United Nations
IATA	International Air Transport Association
IATA/DGR	Dangerous Goods Regulations (DGR) for the air transport (IATA)
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods Code
index No	the Index number is the identification code given to the substance in Part 3 of Annex VI to Regulation (EC) No 1272/2008
IOELV	indicative occupational exposure limit value
MARPOL	International Convention for the Prevention of Pollution from Ships (abbr. of "Marine Pollutant")
NLP	No-Longer Polymer
РВТ	Persistent, Bioaccumulative and Toxic
PNEC	Predicted No-Effect Concentration
ppm	parts per million
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
RID	Règlement concernant le transport International ferroviaire des marchandises Dangereuses (Regulations concerning the International carriage of Dangerous goods by Rail)
STEL	short-term exposure limit
SVHC	Substance of Very High Concern
TWA	time-weighted average
VOC	Volatile Organic Compounds
vPvB	very Persistent and very Bioaccumulative

Key literature references and sources for data

- Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU Regulation (EC) No. 1272/2008 (CLP, EU GHS) Dangerous Goods Regulations (DGR) for the air transport (IATA) International Maritime Dangerous Goods Code (IMDG)

- -

List of relevant phrases (code and full text as stated in chapter 2 and 3)

Code	Text
H226	flammable liquid and vapour
H304	may be fatal if swallowed and enters airways
H312	harmful in contact with skin
H315	causes skin irritation
H319	causes serious eye irritation
H332	harmful if inhaled
H335	may cause respiratory irritation

according to Regulation (EC) No. 1907/2006 (REACH), amended by 2015/830/EU



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Disclaimer

The above information describes exclusively the safety requirements of the product and is based on our present-day knowledge. The information is intended to give you advice about the safe handling of the product named in this safety data sheet, for storage, processing, transport and disposal. The information cannot be transferred to other products. In the case of mixing the product with other products or in the case of processing, the information on this safety data sheet is not necessarily valid for the new made-up material.



SAFETY DATA SHEET

Creation Date 01-Jul-2010

Revision Date 10-Feb-2015

Revision Number 1

1. Identification

Product Name

Cat No. :

Pyrene AC180830000; AC180830250; AC180831000; AC180835000

Benzo[def]phenanthrene Synonyms

Recommended Use Laboratory chemicals.

Uses advised against No Information available Details of the supplier of the safety data sheet

Company **Fisher Scientific** One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100

Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410

Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation Serious Eye Damage/Eye Irritation Specific target organ toxicity (single exposure) Target Organs - Central nervous system (CNS). Specific target organ toxicity - (repeated exposure) Target Organs - Liver.

Category 2 Category 2 Category 3

Category 2

Label Elements

Signal Word Warning

Hazard Statements

Causes skin irritation Causes serious eye irritation May cause drowsiness or dizziness May cause damage to organs through prolonged or repeated exposure



Precautionary Statements

Prevention

Wear protective gloves/protective clothing/eye protection/face protection

Use only outdoors or in a well-ventilated area

Do not breathe dust/fume/gas/mist/vapors/spray

Wash face, hands and any exposed skin thoroughly after handling

Do not get in eyes, on skin, or on clothing

Response

Get medical attention/advice if you feel unwell

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN: Wash with plenty of soap and water

Take off contaminated clothing and wash before reuse

If skin irritation occurs: Get medical advice/attention

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing If eye irritation persists: Get medical advice/attention

Storage

Store in a well-ventilated place. Keep container tightly closed

Store locked up

Disposa

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component Pyrene		CAS-No	Weight %	
		129-00-0	>95	
	4. Fi	rst-aid measures		
Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.			
Skin Contact	Wash off immediately with plenty of water for at least 15 minutes. Obtain medical attention.			
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. Obtain medical attention.			
Ingestion	Do not induce vomiting. Obtain medical attention.			
Most important symptoms/effects Notes to Physician	No information available. Treat symptomatically			
	5. Fire	-fighting measures		
Suitable Extinguishing Media	Use water spray	, alcohol-resistant foam, dry cher	nical or carbon dioxide.	

Suitable Extinguishing Media

Unsuitable Extinguishing Media No information available

Flash Point Method -	210 °C / 410 °F No information available		
Autoignition Temperature	No information available		
Explosion Limits	No data available		
Lower	No data available		
Sensitivity to Mechanical Impac Sensitivity to Static Discharge	t No information available No information available		
Specific Hazards Arising from the Keep product and empty container av	Chemical vay from heat and sources of i	gnition.	
Hazardous Combustion Products Carbon monoxide (CO) Carbon dioxid Protective Equipment and Precauti As in any fire, wear self-contained bre protective gear. Thermal decompositi	le (CO ₂) ons for Firefighters eathing apparatus pressure-de on can lead to release of irritat	mand, MSHA/NIOSH (approv ing gases and vapors.	red or equivalent) and full
NFPA Health 2	Flammability 1	Instability 0	Physical hazards N/A
	6. Accidental rele	ease measures	
Personal Precautions Environmental Precautions	Ensure adequate ventilation. Should not be released into information. Avoid release to	Use personal protective equent the environment. See Section the environment. Collect spi	ipment. Avoid dust formation. 12 for additional ecological llage.
Methods for Containment and Clea Up	n Sweep up or vacuum up spil formation.	lage and collect in suitable co	ontainer for disposal. Avoid dust
	7. Handling a	nd storage	
Handling	Ensure adequate ventilation. Wear personal protective equipment. Avoid contact with skin, eyes and clothing. Avoid dust formation. Avoid breathing dust/fume/gas/mist/vapours/spray. Avoid ingestion and inhalation.		
Storage	Keep containers tightly close	ed in a dry, cool and well-vent	ilated place.
8. E	xposure controls /	personal protection	on
Exposure Guidelines	This product does not contai established by the region sp	n any hazardous materials wi ecific regulatory bodies.	ith occupational exposure limits
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.		
Personal Protective Equipment			
Eye/face Protection	Wear appropriate protective OSHA's eye and face protec EN166.	eyeglasses or chemical safet tion regulations in 29 CFR 19	y goggles as described by 10.133 or European Standard
Skin and body protection	Wear appropriate protective	gloves and clothing to prever	nt skin exposure.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.		

Hygiene Measures

Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Yellow
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	148 - 152 °C / 298 - 306 °F
Boiling Point/Range	393 °C / 739.4 °F @ 760 mmHg
Flash Point	210 °C / 410 °F
Evaporation Rate	No information available
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	No information available
Relative Density	No information available
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C16 H10
Molecular Weight	202.25

10. Stability and reactivity

Reactive Hazard	None known, based on information available	
Stability	Stable under normal conditions.	
Conditions to Avoid	Incompatible products. Excess heat. Avoid dust formation.	
Incompatible Materials	Strong oxidizing agents	
Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO2)		
Hazardous Polymerization	Hazardous polymerization does not occur.	
Hazardous Reactions	None under normal processing.	

11. Toxicological information

Acute Toxicity

Product Information	No acute toxicity information is available for this product				
Component Information	-	-			
Component	LD50 Oral	LD50 Dermal	LC50 Inhalation		
Pyrene 2700 mg/kg (Rat)		Not listed	Not listed		
Toxicologically Synergistic	No information available				
Products					
Delayed and immediate effects	as well as chronic effects from s	hort and long-term exposur	<u>re</u>		
Irritation	Irritating to eyes and skin				
Sensitization No information available					

Carcinogenicity

The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico	
Pyrene	129-00-0	Not listed	Not listed	Not listed	Not listed	Not listed	
Mutagenic Effects		No information available					
Reproductive Effects		No information available.					
Developmental Effects		No information available.					
Teratogenicity		No information available.					
STOT - single exposure STOT - repeated exposure		Central nervous system (CNS) Liver					
Aspiration hazard		No information available					
Symptoms / effects,both acute and		No information available					
Endocrine Disruptor Information		No information available					
Other Adverse Effects		Tumorigenic effects have been reported in experimental animals. The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.					

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. Do not empty into drains. Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Pyrene	Not listed	Oncorhynchus mykiss: LC50	Not listed	EC50 48h 1.8 mg/L
		> 2mg/L 96h		EC50 48h 0.002-0.003 mg/L
Persistence and Degrada	hility No information	on available		

Bioaccumulation/ Accumulation

No information available.

Mobility

Component	log Pow
Pyrene	4.88

13. Disposal considerations

Waste Disposal Methods

Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT	
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Proper technical name	Pyrene
Hazard Class	9
Packing Group	III
TDG	
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s.
Hazard Class	9
Packing Group	III
IATA	

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Packing Group	III
IMDG/IMO	
UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s
Hazard Class	9
Packing Group	

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Pyrene	Х	Х	-	204-927-3	-		Х	Х	Х	Х	-

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable
SARA 313	Not applicable

••••••	

SARA 311/312 Hazardous Categorization	
Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Pyrene	-	-	Х	Х

Clean Air Act

Not applicable

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component		Hazardous Substances RQs	CERCLA EHS RQs
Pyrene		5000 lb	5000 lb
California Proposition 65	This product	does not contain any Proposition 65 che	emicals
State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Pyrene	Х	Х	Х	Х	-

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D2B Toxic materials



16. Other information Prepared By Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com Creation Date 01-Jul-2010 10-Feb-2015 Print Date 10-Feb-2015 Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS



Material Safety Data Sheet sec-Butylbenzene, 99+%

MSDS# 73785 Section 1 - Chemical Product and Company Identification MSDS Name: sec-Butylbenzene, 99+% Catalog AC107860000, AC107860050, AC107860500, AC107861000, AC107862500, AC107865000 Numbers: AC107865000 Synonyms: 2-Phenylbutane; Benzene, (1-methylpropyl)-; (1-Methylpropyl)benzene; Benzene, sec-butyl-Acros Organics BVBA Janssen Pharmaceuticalaan 3a Company Identification: 2440 Geel, Belgium Acros Organics One Reagent Lane Company Identification: (USA) Fair Lawn, NJ 07410 For information in the US, call: 800-ACROS-01 For information in Europe, call: +32 14 57 52 11 Emergency Number, Europe: +32 14 57 52 99 **Emergency Number US:** 201-796-7100 CHEMTREC Phone Number, US: 800-424-9300 CHEMTREC Phone Number, Europe: 703-527-3887

Section 2 - Composition, Information on Ingredients

CAS#:	135-98-8
Chemical Name:	sec-Butylbenzene
%:	99+
EINECS#:	205-227-0

Hazard Symbols:



Risk Phrases:

10 36/37/38

XI

Section 3 - Hazards Identification

EMERGENCY OVERVIEW

Warning! Flammable liquid and vapor. May cause central nervous system depression. Causes eye, skin, and respiratory tract irritation. Target Organs: Central nervous system.

Potential Health Effects

Eye: Causes eye irritation.

Skin: Causes skin irritation.

Ingestion: May cause gastrointestinal irritation with nausea, vomiting and diarrhea. Ingestion of large amounts may cause CNS depression.

Inhalation: Causes respiratory tract irritation.

Chronic: Prolonged or repeated skin contact may cause dermatitis.

Eyes:	Flush eyes medical aid	with plenty of water for at l	east 15 minutes, occasional	lly lifting the upper and l	ower eyelids. Get
Skin:	Get medical aid. Flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse.				
Ingestion:	Do not induce vomiting. If victim is conscious and alert, give 2-4 cupfuls of milk or water. Never give anything by mouth to an unconscious person. Get medical aid.				
Inhalation:	Remove from exposure and move to fresh air immediately. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid.				
Notes to Physician:	Treat symp	tomatically and supportivel	у.		
		Section 5	- Fire Fighting Measures		
General Information:	As in any fi or equivalent to a source of thermal dec containers of	re, wear a self-contained bant), and full protective gear of ignition and flash back. I composition or combustion. cool. Containers may explo	reathing apparatus in press Vapors may form an explo During a fire, irritating and Will burn if involved in a de in the heat of a fire. Flar	ure-demand, MSHA/NI osive mixture with air. V highly toxic gases may b fire. Use water spray to k mmable liquid and vapor	OSH (approved apors can travel be generated by teep fire-exposed
Extinguishing Media:	For small fi water spray be ineffection	res, use dry chemical, carb , fog, or alcohol-resistant f ve. Use agent most appropr	on dioxide, water spray or foam. Use water spray to corriate to extinguish fire. Do	alcohol-resistant foam. I ool fire-exposed contain NOT use straight stream	For large fires, use ers. Water may s of water.
Autoignition Temperature	$^{1}_{:}$ 415 deg C	(779.00 deg F)			
Flash Point	: 45 deg C (113.00 deg F)			
Explosion Limits: Lower	¹ 0.80 vol %				
Explosion Limits: Upper	¹ 6.90 vol %				
NFPA Rating	: health: 2; fla	ammability: 2; instability: 0;			
		Section 6 - A	ccidental Release Measure	es	
General Information:	Use proper	personal protective equipm	ent as indicated in Section	8.	
Spills/Leaks:	Absorb spill spills immed ignition. Use vapors.	with inert material (e.g. ve liately, observing precaution e a spark-proof tool. Provid	rmiculite, sand or earth), th ns in the Protective Equipm de ventilation. A vapor sup	nen place in suitable cont nent section. Remove all pressing foam may be us	ainer. Clean up sources of sed to reduce
		Section 7	- Handling and Storage		
Wash venti Handling: proof and/c Avoi conta	thoroughly lated area. G f equipment. or vapor), and d ingestion a hiners to heat	after handling. Remove cor round and bond containers Avoid contact with eyes, sk d can be dangerous. Keep on inhalation. Do not press r, sparks or open flames.	ntaminated clothing and wa when transferring material kin, and clothing. Empty co container tightly closed. Ko urize, cut, weld, braze, solo	sh before reuse. Use only Use spark-proof tools a ontainers retain product re eep away from heat, spa ler, drill, grind, or expose	y in a well- and explosion esidue, (liquid rks and flame. e empty
Storage: Keep	away trom s	sources of ignition. Store in patible substances Flamma	a tightly closed container.	Store in a cool, dry, wel	I-ventilated area
away	nom meonij	Section 8 - Expose	ure Controls, Personal Prot	tection	
+ Chemical	Name	+ ACGIH	+ NIOSH	+ + OSHA - Final PELs	+
 sec-Butylb	enzene	 none listed	 none listed	 none listed	
T		T		T	Г

OSHA Vacated PELs: sec-Butylbenzene: None listed

Engineering Controls:

Facilities storing or utilizing this material should be equipped with an eyewash facility and a safety shower. Use adequate general or local explosion-proof ventilation to keep airborne levels to acceptable levels.

Exposure Limits

Personal Pro	Protective Equipment	
Eyes:	Wear chemical splash goggles.	
Skin:	Wear appropriate protective gloves to prevent skin exposure.	
Clothing:	Wear appropriate protective clothing to prevent skin exposure.	
Respirators:	A respiratory protection program that meets OSHA's 29 CFR 1910 European Standard EN 149 must be followed whenever workplace	.134 and ANSI Z88.2 requirements or conditions warrant respirator use.
	Section 9 - Physical and Chemical Proper	ties
	Physical State: Liquid	
	Color: clear colorless	
	Odor: None reported.	
	pH: Not available	
	Vapor Pressure: 4 mm Hg @ 37.7 d	deg C
	Vapor Density: 4.62	
	Evaporation Rate: Not available	
	Viscosity: Not available	
	Boiling Point: 173 - 174 deg C (d) 760 mm Hg
	Freezing/Melting Point: -75 deg C (-103.0	00°F)
	Decomposition Temperature: Not available	
	Solubility in water: 0.015 g/L water	
	Specific Gravity/Density: 0.8630 g/cm3	
	Molecular Formula: C10H14	
	Molecular Weight: 134.22	
	Section 10 - Stability and Reactivity	
Chemical St	l Stability: Stable under normal temperat	ures and pressures.
Conditions t	ns to Avoid: Ignition sources, excess heat.	
Incompatibi	tibilities with Other Materials Strong oxidizing agents.	
Hazardous l	us Decomposition Products Carbon monoxide, carbon mo	noxide, carbon dioxide.
Hazardous I	us Polymerization Has not been reported.	
	Section 11 - Toxicological Information	
RTECS#:	CAS# 135-98-8: CY9100000	
	RTECS:	
	CAS# 135-98-8: Draize test, rabbit, eye: 500 mg/24H Mild;	
	Draize test, rabbit, skin: 100 mg/24H Moderate; Oral mouse: LD50 = 8700 mg/kg :	
LD50/LC50	C50: $Oral, rat: LD50 = 2240 \text{ uL/kg};$	
	Oral, rat: $LD50 = 6300 \text{ mg/kg};$	
	Skin, rabbit: $LD50 = >16 \text{ mL/kg};$	
а · ·		
Carcinogeni	enicity: sec-Butylbenzene - Not listed as a carcinogen by ACGIH, IA	ARC, NTP, or CA Prop 65.
Other:	See actual entry in RTECS for complete information.	
T / 111	Section 12 - Ecological Information	
lot available	le Costian 12 Disposal Considerations	
D' ('	Section 13 - Disposal Considerations	
Dispose of i	of in a manner consistent with federal, state, and local regulations.	
	Section 14 - Transport Information	
JS DUI hinning Nam	ame: BUTYL BENZENES	
Hazard Class:	ss: 3	
JN Number: U	er: UN2709	
acking Group	oup: III	
Canada TDG	G	

Shipping Name: Not available Hazard Class: UN Number: Packing Group:

Section 15 - Regulatory Information

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XI

Risk Phrases:

R 10 Flammable.

R 36/37/38 Irritating to eyes, respiratory system and skin.

Safety Phrases:

S 9 Keep container in a well-ventilated place.

S 16 Keep away from sources of ignition - No smoking.

S 33 Take precautionary measures against static discharges.

WGK (Water Danger/Protection)

CAS# 135-98-8: 1

Canada

CAS# 135-98-8 is listed on Canada's DSL List

Canadian WHMIS Classifications: B3, D2B

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations and the MSDS contains all of the information required by those regulations.

CAS# 135-98-8 is not listed on Canada's Ingredient Disclosure List.

US Federal

TSCA

CAS# 135-98-8 is listed on the TSCA Inventory.

Section 16 - Other Information MSDS Creation Date: 9/02/1997 Revision #9 Date 7/20/2009

The information above is believed to be accurate and represents the best information currently available to us. However, we make no warranty of merchantibility or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes. In no event shall the company be liable for any claims, losses, or damages of any third party or for lost profits or any special, indirect, incidental, consequential, or exemplary damages howsoever arising, even if the company has been advised of the possibility of such damages.



SAFETY DATA SHEET

Revision Date 10-Feb-2015

Revision Number 1

1. Identification			
Product Name	Selenium		
Cat No. :	AC419270000; AC419271000;	AC419275000	
Synonyms	None		
Recommended Use	Laboratory chemicals.		
Uses advised against Details of the supplier of the safety	No Information available <u>/ data sheet</u>		
Company Fisher Scientific One Reagent Lane Fair Lawn, NJ 07410 Tel: (201) 796-7100	Entity / Business Name Acros Organics One Reagent Lane Fair Lawn, NJ 07410	Emergency Telephone Number For information US call: 001-800-ACROS-01 / Europe call: +32 14 57 52 11 Emergency Number US:001-201-796-7100 / Europe: +32 14 57 52 99 CHEMTREC Tel. No.US:001-800-424-9300 / Europe:001-703-527-3887	

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity
Acute Inhalation Toxicity - Dusts and Mists
Specific target organ toxicity - (repeated exposure)

Category 3 Category 3 Category 2

Label Elements

Signal Word Danger

Hazard Statements

Toxic if swallowed Toxic if inhaled May cause damage to organs through prolonged or repeated exposure



Precautionary Statements Prevention

Wash face, hands and any exposed skin thoroughly after handling Do not eat, drink or smoke when using this product Use only outdoors or in a well-ventilated area Do not breathe dust/fume/gas/mist/vapors/spray Response Get medical attention/advice if you feel unwell Inhalation IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Call a POISON CENTER or doctor/physician Ingestion IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician Rinse mouth Storage Store locked up Store in a well-ventilated place. Keep container tightly closed Disposal Dispose of contents/container to an approved waste disposal plant Hazards not otherwise classified (HNOC) May cause long lasting harmful effects to aquatic life

3. Composition / information on ingredients

Component		CAS-No	Weight %		
Selenium		7782-49-2	> 99.5		
	4. First-aid measures				
Eye Contact	Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes.				
Skin Contact Wash off immediately with soap and plenty of water while removing all contaminat clothes and shoes.			while removing all contaminated		
Inhalation Remove from exposure, lie down. Move to fresh air. If breathing is difficult, give on to breathing, give artificial respiration. Immediate medical attention is required.			If breathing is difficult, give oxygen. If edical attention is required.		
Ingestion Do not induce vomiting. Never give anything by mouth to an unconscious person. I plenty of water. Call a physician immediately. If possible drink milk afterwards.			th to an unconscious person. Drink ible drink milk afterwards.		
Most important symptoms/effects Notes to Physician	ost important symptoms/effectsNo information available.otes to PhysicianTreat symptomatically				
	5. Fi	re-fighting measures			
Suitable Extinguishing Media	Water spray.	Carbon dioxide (CO 2). Dry chemical. cl	nemical foam.		
Unsuitable Extinguishing Media	No informatio	on available			
Flash Point Method -	Point No information available od - No information available				
Autoignition Temperature Explosion Limits	No informatio	on available			
Upper Lower Sensitivity to Mechanical Impact Sensitivity to Static Discharge	No data avail No data avail No informatic No informatic	able able on available on available			

Specific Hazards Arising from the Chemical

Vapors may form explosive mixtures with air.

Hazardous Combustion Products

None known

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA Health 3	Flammability 0	Instability 0	Physical hazards N/A
	6. Accidental re	lease measures	
Personal Precautions Environmental Precautions	Ensure adequate ventilatio See Section 12 for addition Collect spillage.	n. Use personal protective equinal ecological information. Avoid	ipment. d release to the environment.

Methods for Containment and Clean Sweep up or vacuum up spillage and collect in suitable container for disposal. Up

	7. Handling and storage
Handling	Avoid contact with skin and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Use only in area provided with appropriate exhaust ventilation.
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep under nitrogen.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Selenium	TWA: 0.2 mg/m ³	(Vacated) TWA: 0.2 mg/m ³	IDLH: 1 mg/m ³
			TWA: 0.2 mg/m ³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Selenium	TWA: 0.2 mg/m ³	TWA: 0.2 mg/m ³	TWA: 0.2 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures	Ensure that eyewash stations and safety showers are close to the workstation location.			
Personal Protective Equipment				
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.			
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.			
Respiratory Protection	A NIOSH/MSHA approved air purifying dust or mist respirator or European Standard EN 149.			
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.			
(9. Physical and chemical properties			

Physical State Appearance Odor Odor Threshold pH Melting Point/Range Boiling Point/Range Flash Point Evaporation Rate Flammability (solid,gas) Flammability or explosive limits Upper Lower Vapor Pressure Vapor Pressure Vapor Density Relative Density Solubility Partition coefficient; n-octanol/water Autoignition Temperature Decomposition Temperature Viscosity Molecular Formula	Powder Solid Grey No information available No information available 217 - 222 °C / 422.6 - 431.6 °F 685 °C / 1265 °F No information available No information available No information available No data available No data available 1 mmHg @ 345 °C No information available 4.810 No information available No data available No information available
Molecular Weight	78.96

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products.
Incompatible Materials	Acids, Strong oxidizing agents, Fluorine, oxygen, Metals
Hazardous Decomposition Products	s None under normal use conditions
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Selenium

7782-49-2

Not listed

Product Information		No acute toxicity information is available for this product								
		LD50 Oral		D50 Dermal	1 C 50	Inhalation				
Component					L030					
Selenium		6700 mg/kg (Rat)		Not listed	NO	ot listed				
Toxicologically Synergist	ic	No information ava	ailable							
Products										
Delayed and immediate et	ffects as we	ell as chronic effe	cts from short an	d long-term expo	<u>sure</u>					
Irritation		No information ava	ailable							
Sensitization		No information ava	ailable							
Carcinogenicity		The table below in	dicates whether ea	ach agency has lis	ted any ingredient	as a carcinogen.				
Component C	AS-No	IARC	NTP	ACGIH	OSHA	Mexico				

Not listed

Not listed

Not listed

Not listed

Mutagenic Effects	No information available							
Reproductive Effects	No information available.							
Developmental Effects	No information available.							
Teratogenicity	No information available.							
STOT - single exposure STOT - repeated exposure	Jone known Jone known							
Aspiration hazard	No information available							
Symptoms / effects,both acute and delayed	No information available							
Endocrine Disruptor Information	No information available							
Other Adverse Effects	The toxicological properties have not been fully investigated.							
	12. Ecological information							
Ecotoxicity Do not empty into drains.								
Persistence and Degradability Bioaccumulation/ Accumulation	No information available No information available.							
Mobility	No information available.							
	13. Disposal considerations							
Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.							
	14. Transport information							
DOT	· · · · · · · · · · · · · · · · · · ·							
	1102202							
Hazaro Class	0.1							
Packing Group	11							
TDG								
UN-No	UN3283							
Hazard Class	6.1							
Packing Group	111							
ΙΑΤΑ								
LIN-No	3283							
Proper Shinning Name	SELENIUM COMPOLIND, SOLID, N.O.S.							
Hazard Class	61							
Dooking Group								
	111							
	2222							
UN-No	3283							
Proper Shipping Name	SELENIUM COMPOUND, SOLID, N.O.S.							
Hazard Class	6.1							
Packing Group								
	15. Regulatory information							

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Selenium	Х	Х	-	231-957-4	-		Х	-	Х	Х	Х

Legend: X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Not applicable

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Selenium	7782-49-2	> 99.5	1.0

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Selenium	-	-	Х	X

Clean Air Act

Not applicable

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Selenium	Х		-

OSHA Occupational Safety and Health Administration Not applicable

CERCLA

This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs		
Selenium	100 lb	-		

California Proposition 65 This product does not contain any Proposition 65 chemicals

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Selenium	Х	Х	Х	Х	Х

U.S. Department of Transportation

Reportable Quantity (RQ):	Ν
DOT Marine Pollutant	Ν
DOT Severe Marine Pollutant	Ν

U.S. Department of Homeland Security

This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade

No information available

Canada

This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class

D1A Very toxic materials D2B Toxic materials



16. Other information

Regulatory Affairs Thermo Fisher Scientific Email: EMSDS.RA@thermofisher.com

Revision Date Print Date Revision Summary 10-Feb-2015 10-Feb-2015 This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

Prepared By

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS

SAFETY DATA SHEET

Version 4.6 Revision Date 12/02/2015 Print Date 02/09/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Silver
	Product Number Brand	:	327093 Aldrich
	CAS-No.	:	7440-22-4

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses	:	Laboratory chemicals,	Synthesis	of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

Not a hazardous substance or mixture.

2.2 GHS Label elements, including precautionary statements

Not a hazardous substance or mixture.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	Ag
Molecular weight	:	107.87 g/mol
CAS-No.	:	7440-22-4
EC-No.	:	231-131-3

Hazardous components

Component	Classification	Concentration
Silver		
		<= 100 %

4. FIRST AID MEASURES

4.1 Description of first aid measures

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration.

In case of skin contact

Wash off with soap and plenty of water.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Silver/silver oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Avoid dust formation. Avoid breathing vapours, mist or gas. For personal protection see section 8.

6.2 Environmental precautions No special environmental precautions required.

- **6.3** Methods and materials for containment and cleaning up Sweep up and shovel. Keep in suitable, closed containers for disposal.
- 6.4 **Reference to other sections** For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

Air sensitive. Store under inert gas. Keep in a dry place. Storage class (TRGS 510): Non Combustible Solids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
			parameters	
Silver	7440-22-4	TWA	0.010000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.010000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.100000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Argyria		
		TWA	0.010000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	0.010000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		TWA	0.010000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	0.100000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Argyria		
		TWA	0.010000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	0.1 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Argyria	•	· · · · ·
		TWA	0.01 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants

8.2 Exposure controls

Appropriate engineering controls General industrial hygiene practice.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Choose body protection in relation to its type, to the concentration and amount of dangerous substances, and to the specific work-place., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Respiratory protection is not required. Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

No special environmental precautions required.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: powder
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: 960 °C (1,760 °F) - lit.
f)	Initial boiling point and boiling range	2,212 °C (4,014 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	10.49 g/cm3
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	er safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Oxygen, Strong acids and strong bases

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - male - > 5,000 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

Carcinogenicity

Carcinogenicity - Rat - Unreported Tumorigenic:Tumors at site or application.

Carcinogenicity classification not possible from current data.

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

. No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: Not available May cause argyria (a slate-gray or bluish discoloration of the skin and deep tissues due to the deposit of insoluble albuminate of silver).

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substances, solid, n.o.s. (Silver) Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

ΙΑΤΑ

Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels establish	ned by SARA Title III,	Section 313:
	CAS-No.	Revision Date
Silver	7440-22-4	1993-04-24
SARA 311/312 Hazards No SARA Hazards		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Silver	7440-22-4	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date

Silver	7440-22-4	1993-04-24	
New Jersey Right To Know Components		Devision Data	
Silver	CAS-NO. 7440-22-4	1993-04-24	
California Prop. 65 Components			

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

HMIS Rating	
Health hazard:	0
Chronic Health Hazard:	
Flammability:	0
Physical Hazard	0
NFPA Rating	
Health hazard:	0
Fire Hazard:	0
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.6

Revision Date: 12/02/2015

Print Date: 02/09/2016



SAFETY DATA SHEET

SECTION 1 - CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

1.1 - Product Identifiers

Catalog Name: PFOS-012S

Description: Sodium 1H,1H,2H,2H-perfluoro-1-octanesulfonate in Methanol

1.2 - Relevant Identified Uses of the Substance or Mixture

Laboratory Chemical Reference Material

1.3 - Supplier Details

Company: AccuStandard, Inc. 125 Market St. New Haven, CT 06513 USA

Telephone Number: 203-786-5290

Fax: 203-786-5287

Email: edocs@accustandard.com

1.4 - Emergency Telephone Number

Emergency Phone #: AccuStandard, Inc. 1-203-502-7070 (USA) +001-203-502-7070 (International)

24 hours / 7 days a week

SECTION 2 - HAZARDS IDENTIFICATION

2.1 - GHS Label Elements





*	2	HEALTH
	3	FLAMMABILITY
	0	PHYSICAL HAZARD

Signal Word: Danger

Hazard Codes:

H225 - Highly Flammable (Flammable liquids, category 2)

H301 - Toxic if swallowed. (Acute toxicity, oral, category 3)

H311 - Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

H315 - Irritating to skin. (Skin corrosion/irritation, category 2)

H320 - Irritating to eyes. (Eye damage/irritation, category 2B)

H332 - Harmful if inhaled. (Acute toxicity, inhalation, category 4)

H336 - Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

H360 - California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

H370 - Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

Precautionary Codes:

SECTION 2 - HAZARDS IDENTIFICATION - continued

2.1 - GHS Label Elements - continued

P202 - This product should only by used by persons trained in the safe handling of hazardous chemicals.

P233 - Store in a tightly closed container. (P404)

P262 - Do not get in eyes, on skin or clothing.

P264 - Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available.

P280 - Protective gloves must be worn to prevent skin contact.

P284 - Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

P331 - Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person.

P338 - Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers.

P360 - Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse.

2.2 - Other Hazards

2.2.1 - Symptom of Exposure Health/Environment

Highly Flammable (Flammable liquids, category 2)

Causes damage to organs. (Specific target organ toxicity, single exposure, category 1)

After ingestion or inhalation, initial symptoms may be only that of mild intoxication, but may become severe after 12 or 18 hours.

POISON: May be fatal or cause blindness if swallowed.

Overexposure may cause dizziness, nausea, muscle weakness, narcosis and respiratory failure.

2.2.2 - Potential Health Effects

Irritating to eyes. (Eye damage/irritation, category 2B)

Irritating to skin. (Skin corrosion/irritation, category 2)

Toxic if absorbed through skin. (Acute toxicity, dermal, category 3)

Irritating to mucous membrane and upper respiratory system.

Harmful if inhaled. (Acute toxicity, inhalation, category 4)

Toxic if swallowed. (Acute toxicity, oral, category 3)

2.2.3 - Routes of Entry

Inhalation, ingestion or skin contact.

2.2.4 - Carcinogenicity

California Proposition 65 Warning: This product contains a component (or components) that may cause birth defects or other reproductive harm in a quantity greater than or equal to 0.1%.

SECTION 3 - COMPOSITION / ANALYTES DATA

Description: Sodium 1H,1H,2H,2H-perfluoro-1-octanesulfonate in Methanol

SECTION 3 - COMPOSITION / ANALYTES DATA - continued

			ACGIH -TLV (mg/m ³)		OSHA -PEL (mg/m ³)		g/m³)	
Analyte	CAS #	% Concentration	TWA	STEL	Skin	TWA	STEL	Skin
Sodium 1H,1H,2H,2H-per fluoro-1-octanesulfonate	N/A	0.010						
Methanol	67-56-1	99.990				260		

SECTION 4 - FIRST AID MEASURES

4.1 - First Aid Procedures - General

Get medical assistance for all cases of overexposure.

4.2 - Eye Contact

Eye contact: Immediately flush with plenty of water. After initial flushing, remove and contact lenses and continue flushing for at least 15 minutes. Assure adequate flushing by separating the eyelids with fingers. (P338)

4.3 - Skin Contact

Skin contact: Immediately wash skin with soap and plenty of water. Remove contaminated clothing. Get medical attention if symptoms occur. Wash clothing before reuse. (P360)

4.4 - Inhalation

Inhalation: Remove to fresh air. If not breathing, give artificial respiration or give oxygen by trained personnel. Seek immediate medical attention.

4.5 - Ingestion

Ingestion: Do NOT induce vomiting. Call a physician or poison control center immediately. Never give anything by mouth to an unconscious person. (P331)

SECTION 5 - FIRE FIGHTING MEASURES

5.1 - Flammable Properties

Dangerous fire and explosive hazard.

Containers can build up pressure if exposed to heat.

Vapors can travel to a source of ignition and flash back.

During a fire, irritating and highly toxic gases may be generated by thermal decomposition or combustion.

5.2 - Extinguishing Media

Use alcohol foam, carbon dioxide, dry chemical, or water spray when fighting fires involving this material.

5.3 - Protection of Firefighters

As in any fire, wear self-contained breathing apparatus pressure demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

SECTION 6 - ACCIDENTAL RELEASE MEASURES

6.1 - Spill Response

Wear suitable protective equipment listed under Exposure Controls / Personal Protection. Eliminate any ignition sources until the area is determined to be free from explosion or fire hazards. Contain the release and eliminate its source, if this can be done without risk. Dispose as hazardous waste. Comply with Federal, State and local regulations.

SECTION 7 - HANDLING AND STORAGE

Store in a tightly closed container. (P404)

Store in a cool area away from ignition sources and oxidizers.

Avoid breathing vapors or mists.

Use with adequate ventilation.

Do not get in eyes, on skin or clothing. (P262)

Avoid prolonged or repeated exposure.

This product should only by used by persons trained in the safe handling of hazardous chemicals. (P202)

SECTION 8 - EXPOSURE CONTROLS

8.1 - Engineering Controls/PPE

Wash thoroughly after handling. Do not take internally. Eye wash and safety equipment should be readily available. (P264)

8.2 - General Hygene Considerations

Respiratory Protection: If workplace exposure limit(s) of product or any component is exceeded (see TLV/PEL), or a risk assessment shows air-purifying respirators are appropriate, use of a NIOSH/MSHA approved air supplied respirator is advised. Use a full-face respirator with multi-purpose combination (US) or type ABEK (EN14387) respirator cartridges in absence of proper environmental control. Always use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU). Engineering and/or administrative controls should be implemented to reduce exposure.

Material should be handled or transferred in an approved fume hood or with adequate ventilation.

Protective gloves must be worn to prevent skin contact. (P280)

(Chloroprene, natural rubber, nitrile, or equivalent)

Use eye protection tested and approved under the appropriate government standards such as NIOSH (US) or EN 166 (EU).

All recommendations are advisory only and must be evaluated by an industrial hygienist and/or safety officer familiar with the specific situation of anticipated use, such as concentration and amount of the substance in the workplace. Any recommendation should not be construed as offering an approval for any specific use of the product.

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Clear liquid Odor: N/A Odor Threshold: N/A pH: N/A Melting Point: -93.9 °C Boiling Point: 65 °C Flash Point: 52 °F (11 °C) (tcc) Evaporation Rate (Butyl Acetate=1): 5.9 Flammability Class: N/A Lower Flammability Level: 6.7 Upper Flammability Level: 6.7 Upper Flammability Level: 36.5 Vapor Pressure: 97 mmHg (20 °C) Vapor Density (Air = 1): 1.1 g/L Specific Gravity: 0.791 g/cm3

SECTION 9 - PHYSICAL AND CHEMICAL PROPERTIES - continued

Solubility in Water: Very soluble Partition Coefficient: log Pow: -0.77 Autoignition Temperature: 385 °C Decomposition Temperature: N/A Viscosity: N/A VOC Content: N/A Percent Volatile: 99.9+

SECTION 10 - STABILITY AND REACTIVITY

Stability: Stable Materials to Avoid: Acids Oxidizers Hazardous Decomposition: Oxides of carbon; Formaldehyde Hazardous Polymerization: Will not occur Condition to Avoid: Heat; Contact with ignition sources

SECTION 11 - TOXICOLOGICAL INFORMATION

Human Health Toxicity

See section 2 for specific toxicological information for the ingredients of this product.

LD50 (Oral): Human - 143 mg/kg; Rat - 1500 mg/kg

LD50 (Dermal) : Rabbit - >2000 mg/kg

LC50 (Inhalation): Rat - >20 mg/L

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

No other information related to the toxicological properties of this product is available at this time.

SECTION 12 - ECOLOGICAL INFORMATION

Environmental Toxicity

By complying with sections 6 and 7 there should be no release to the environment.

LC50 (Fish): >1000 mg/L 96H

EC50 (Aquatic Invertebrate): >1000 mg/L 48H

BCF: 1.0

Hydrolyzes readily on contact with water. Readily biodegradable.

No other information related to the ecological properties of this product is available at this time.

SECTION 13 - DISPOSAL CONSIDERATIONS

Recycle or incinerate at any EPA approved facility or dispose in compliance with Federal, State and local regulations. Empty containers must be triple-rinsed prior to disposal.

SECTION 14 - TRANSPORT INFORMATION

Transportation Information (DOT/IATA)

SECTION 14 - TRANSPORT INFORMATION - continued

UN Number: UN1230 Class: 3 Packing Group: II Proper Shipping Name: Methanol Poison by Inhalation: No Marine Pollutant: No

SECTION 15 - REGULATORY INFORMATION

WARNING: This product contains chemicals known to the state of California to cause birth defects or other reproductive harm.

This product is subject to SARA section 313 reporting requirements.

Not all components are listed on the TSCA Inventory.

For laboratory, research and development use only. Not for manufacturing or commercial purposes.

In addition to federal and state regulations, local regulations may apply. Check with your local regulatory authorities.

SECTION 16 - OTHER INFORMATION

This document has been designed to meet the requirements of OSHA, ANSI, GHS and CHIPs regulations. Chemicals are classified using the Globally Harmonized System for Classification and Labeling of Chemicals and CLP Regulation (EC) No. 1272/2008.

The statements contained herein are offered for informational purposes only and are based on technical data that we believe to be accurate. The manufacturer will not assume any liability for the accuracy and completeness of this information. Final determination of the suitability of the material is the responsibility of the user. Although certain hazards are described herein, the user should not presume that these are the only hazards that exist. Since conditions and manner of use are outside of the manufacturers control, we make

NO WARRANTY OF MERCHANTABILITY, EXPRESSED OR IMPLIED, AND ASSUME NO LIABILITY RESULTING FROM ITS USE.

Legend : N/A = Not Available ND = Not Determined NR = Not Regulated

Alteration of any information contained herein without written permission from the manufacturer is strictly prohibited.

HMIS/NFPA HAZARD INDEX

- 0 Minimal
- 1 Slight
- 2 Moderate
- 3 Serious
- 4 Severe
- * Additional Hazard

GHS HAZARD INDEX

Category 1 - Most Severe Category 5 - Least Severe

**** End of Document ****

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 4.11 Revision Date 03/05/2015 Print Date 02/07/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Sodium
	Product Number Brand	:	483745 Aldrich
	CAS-No.	:	7440-23-5

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Manufacture of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Substances and mixtures, which in contact with water, emit flammable gases (Category 1), H260 Skin corrosion (Category 1B), H314 Serious eye damage (Category 1), H318 Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Danger
Hazard statement(s)	
H260	In contact with water releases flammable gases which may ignite spontaneously.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H350	May cause cancer.
Precautionary statement(s	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P223	Keep away from any possible contact with water, because of violent reaction and possible flash fire.

P260 Do not breathe dust or mist.	
P264 Wash skin thoroughly after handling.	
P280 Wear protective gloves/ protective clothing/ eye protection/ face protection.	
P281 Use personal protective equipment as required.	
P301 + P330 + P331 IF SWALLOWED: Rinse mouth. Do NOT induce vomiting.	
P303 + P361 + P353 IF ON SKIN (or hair): Remove/ Take off immediately all contamina clothing. Rinse skin with water/ shower.	ted
P304 + P340 + P310 IF INHALED: Remove victim to fresh air and keep at rest in a posi comfortable for breathing. Immediately call a POISON CENTER o doctor/ physician.	tion r
P305 + P351 + P338 + P310 IF IN EYES: Rinse cautiously with water for several minutes. Rem contact lenses, if present and easy to do. Continue rinsing. Immed call a POISON CENTER or doctor/ physician.	ove liately
P308 + P313 IF exposed or concerned: Get medical advice/ attention.	
P335 + P334 Brush off loose particles from skin. Immerse in cool water/ wrap in bandages.	wet
P363 Wash contaminated clothing before reuse.	
P370 + P378 In case of fire: Use dry sand, dry chemical or alcohol-resistant foa extinction.	m for
P402 + P404Store in a dry place. Store in a closed container.P405Store locked up.	
P501 Dispose of contents/ container to an approved waste disposal plan	nt.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS Reacts violently with water.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.2 **Mixtures**

Formula

Na : Molecular weight : 22.99 g/mol

Hazardous components

Thana a da			
Component		Classification	Concentration
Sodium			
CAS-No.	7440-23-5	Water-react. 1; Skin Corr. 1B;	>= 90 - <= 100
EC-No.	231-132-9	Eye Dam. 1; H260, H314	%
Index-No.	011-001-00-0		
Paraffin oils		I	1
CAS-No.	8012-95-1	Carc. 1A; H350	>= 90 - <= 100
EC-No.	232-384-2		%

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Take off contaminated clothing and shoes immediately. Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Dry powder

5.2 Special hazards arising from the substance or mixture No data available

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Sweep up and shovel. Contain spillage, and then collect with an electrically protected vacuum cleaner or by wetbrushing and place in container for disposal according to local regulations (see section 13). Do not flush with water. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed.Keep away from sources of ignition - No smoking.

For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Never allow product to get in contact with water during storage.

Handle and store under inert gas. Air sensitive. Storage class (TRGS 510): Hazardous materials, which set free flammable gases upon contact with water

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis	
			parameters		
Paraffin oils	8012-95-1	STEL	10.000000	USA. ACGIH Threshold Limit Values	
			mg/m3	(TLV)	
		TWA	5.000000	USA. Occupational Exposure Limits	
			mg/m3	(OSHA) - Table Z-1 Limits for Air	
				Contaminants	
		TWA	5.000000	USA. NIOSH Recommended	
			mg/m3	Exposure Limits	
		ST	10.000000	USA. NIOSH Recommended	
			mg/m3	Exposure Limits	
		TWA	5.000000	USA. Occupational Exposure Limits	
			mg/m3	(OSHA) - Table Z-1 Limits for Air	
				Contaminants	
		TWA	5.000000	USA. ACGIH Threshold Limit Values	
			mg/m3	(TLV)	
	Remarks	Upper Resp	iratory Tract irritation	on	
		2014 Adopti	on		
		Not classifia	ble as a human ca	rcinogen	
		Upper Resp	iratory Tract irritation	on	
		2014 Adopti	on		
		Exposure by all routes should be carefully controlled to levels as low			
		as possible.			
		Suspected h	uman carcinogen		
		TWA	5.000000	USA. Occupational Exposure Limits	
			mg/m3	(OSHA) - Table Z-1 Limits for Air	
				Contaminants	
		TWA	5.000000	USA. Occupational Exposure Limits	
			mg/m3	(OSHA) - Table Z-1 Limits for Air	
				Contaminants	
		Upper Resp	iratory Tract irritation	on	
		Exposure by	all routes should l	be carefully controlled to levels as low	
		as possible.			
		Suspected h	uman carcinogen		
		TWA	5.000000	USA. ACGIH Threshold Limit Values	
			mg/m3	(TLV)	
		Upper Resp	iratory Tract irritation	on	
		Not classifia	ble as a human ca	rcinogen	
		TWA	5.000000	USA. NIOSH Recommended	
			mg/m3	Exposure Limits	
		ST	10.000000	USA. NIOSH Recommended	
			mg/m3	Exposure Limits	
		Upper Resp	iratory Tract irritation	on	
		Exposure by all routes should be carefully controlled to levels as low			
		as possible.			
		Suspected human carcinogen			

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant protective clothing, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

Appearance	Form: Pieces
Odour	No data available
Odour Threshold	No data available
рН	No data available
Melting point/freezing point	Melting point/range: 97.8 °C (208.0 °F) - lit.
Initial boiling point and boiling range	883 °C (1,621 °F) - lit.
Flash point	82 °C (180 °F)
Evaporation rate	No data available
Flammability (solid, gas)	No data available
Upper/lower flammability or explosive limits	No data available
Vapour pressure	No data available
Vapour density	No data available
Relative density	0.97 g/cm3
	Appearance Odour Odour Threshold pH Melting point/freezing point Initial boiling point and boiling range Flash point Evaporation rate Flammability (solid, gas) Upper/lower flammability or explosive limits Vapour pressure Vapour density Relative density

	n)	Water solubility	No data available
	o)	Partition coefficient: n- octanol/water	No data available
	p)	Auto-ignition temperature	No data available
	q)	Decomposition temperature	No data available
	r)	Viscosity	No data available
	s)	Explosive properties	No data available
	t)	Oxidizing properties	No data available
9.2	Otl No	her safety information data available	
10. S	TAB	ILITY AND REACTIVITY	
10.1	Re No	activity data available	
10.2	Ch Sta	emical stability able under recommended a	storage conditions.
10.3	Po Re	ssibility of hazardous re acts violently with water.	actions
10.4	Co Air Exp	nditions to avoid Do not allow water to enter posure to moisture	er container.
10.5	Inc Ox	compatible materials idizing agents	
10.6	Ha Oth In t	zardous decomposition ner decomposition product the event of fire: see section	products is - No data available on 5
11. T	OXIC	COLOGICAL INFORMATI	ON
11.1	Inf	ormation on toxicologica	al effects
	Ac No	ute toxicity data available	
	Inh	alation: No data available	
	De	rmal: No data available	
	No	data available	
	Sk No	in corrosion/irritation data available	
	Se No	rious eye damage/eye ir data available	ritation
	Re No	spiratory or skin sensiti data available	sation
	Ge No	rm cell mutagenicity data available	
	Ca	rcinogenicity	
	IAF	RC: 1 - Group 1: Car	cinogenic to humans (Paraffin oils)
Aldrich	- 483	3745	

- NTP: Known to be human carcinogenThe reference note has been added by TD based on the background information of the NTP. (Paraffin oils)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure

No data available

Aspiration hazard

No data available

Additional Information

RTECS: Not available

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin., Aspiration may lead to:, lipid pneumonia, Effects due to ingestion may include:, laxative effect, Gastrointestinal disturbance, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted
- **12.6 Other adverse effects** No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1428 Class: 4.3 Proper shipping name: Sodium Reportable Quantity (RQ): 10 lbs Packing group: I

IMDG

UN number: 1428 Class: 4.3 Proper shipping name: SODIUM

Packing group: I

EMS-No: F-G, S-N

ΙΑΤΑ

UN number: 1428 Class: 4.3 Proper shipping name: Sodium IATA Passenger: Not permitted for transport Packing group: I

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

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SARA 311/312 Hazards

Reactivity Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Sodium	7440-23-5	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Sodium	7440-23-5	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Sodium	7440-23-5	1993-04-24
Paraffin oils	8012-95-1	2007-03-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Paraffin oils	8012-95-1	1987-02-27

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Carc.	Carcinogenicity
Eye Dam.	Serious eye damage
H260	In contact with water releases flammable gases which may ignite spontaneously.
H314	Causes severe skin burns and eye damage.
H318	Causes serious eye damage.
H350	May cause cancer.
Skin Corr.	Skin corrosion
Water-react.	Substances and mixtures, which in contact with water, emit flammable gases

HMIS Rating

Health hazard:	3
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	2

NFPA Rating

Health hazard:	3
Fire Hazard:	4
Reactivity Hazard:	2
Special hazard.I:	W

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.11

Revision Date: 03/05/2015

Print Date: 02/07/2016

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SAFETY DATA SHEET

Version 3.14 Revision Date 12/02/2015 Print Date 02/18/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Styrene	
	Product Number Brand Index-No.	:	240869 Aldrich 601-026-00-0	
	CAS-No.	:	100-42-5	

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 6310 USA	
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052	

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226 Acute toxicity, Inhalation (Category 4), H332 Skin irritation (Category 2), H315 Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Reproductive toxicity (Category 2), H361 Specific target organ toxicity - repeated exposure (Category 1), H372 Acute aquatic toxicity (Category 2), H401

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Signal word	Danger
Hazard statement(s)	
H226	Flammable liquid and vapour.
H315	Causes skin irritation.
H319	Causes serious eye irritation.
H332	Harmful if inhaled.
H351	Suspected of causing cancer.
H361	Suspected of damaging fertility or the unborn child.
0.40000	

H372	Causes damage to organs through prolonged or repeated exposure.
H401	Toxic to aquatic life.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and
	understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ ventilating/ lighting/ equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
	protection.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing.
	Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for
	breathing. Call a POISON CENTER or doctor/ physician if you feel
	unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
	contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to
	extinguish.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS Lachrymator.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: Phenylethylene Vinylbenzene	;
Formula	: C ₈ H ₈ C ₈ H ₈	
Molecular weight	: 104.15 g/mol	
CAS-No.	: 100-42-5	
EC-No.	: 202-851-5	
Index-No.	: 601-026-00-0	

Hazardous components

Component	Classification	Concentration
Styrene		
	Flam. Liq. 3; Acute Tox. 4; Skin Irrit. 2; Eye Irrit. 2A; Carc. 2; Repr. 2; STOT RE 1; Aquatic Acute 2; H226, H315, H319, H332, H351, H361, H372, H401	<= 100 %
4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides Container explosion may occur under fire conditions. Vapours may

Container explosion may occur under fire conditions., Vapours may form explosive mixture with air.

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Recommended storage temperature 2 - 8 °C

Light sensitive.

Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis	
Styrene	100-42-5	TWA	50.000000 ppm 215.000000 mg/m3	USA. NIOSH Recommended Exposure Limits	
		ST	100.000000 ppm 425.000000 mg/m3	USA. NIOSH Recommended Exposure Limits	
	Remarks	See Table Z			
		TWA	100.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
		Z37.15-1969)		
		CEIL	200.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
		Z37.15-1969)		
		Peak	600.000000 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	
		Z37.15-1969)		
		TWA	20.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		Central Nerv Upper Respi Peripheral n Substances (see BEI® se Not classifial	Central Nervous System impairment Upper Respiratory Tract irritation Peripheral neuropathy Substances for which there is a Biological Exposure Index or (see BEI® section) Not classifiable as a human carcinogen		
		STEL	40.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)	
		Central Nerv Upper Respi Peripheral n Substances (see BEI® so Not classifia	Yous System impair iratory Tract irritation europathy for which there is a ection) ble as a human ca	rment on a Biological Exposure Index or Indices rcinogen	
		TWA	100 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2	

CEIL	200 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
Z37.15-1	969	
Peak	600 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-2
Z37.15-1	969	

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological specimen	Basis	
Styrene	100-42-5	Mandelic acid plus phenylglyoxyl ic acid	400mg/g Creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)	
	Remarks	End of shift (As	s soon as po	ssible after exposure	e ceases)	
		Styrene	0.2000 mg/l	In venous blood	ACGIH - Biological Exposure Indices (BEI)	
		End of shift (As	s soon as po	ssible after exposure	e ceases)	
		Mandelic acid plus phenylglyoxyl ic acid	400mg/g Creatinine	Urine	ACGIH - Biological Exposure Indices (BEI)	
		End of shift (As	s soon as po	ssible after exposure	e ceases)	
		Styrene	40 µg/l	Urine	ACGIH - Biological Exposure Indices (BEI)	
		End of shift (As soon as possible after exposure ceases)				

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 32 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	sweet
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -31 °C (-24 °F) - lit.
f)	Initial boiling point and boiling range	145 - 146 °C (293 - 295 °F) - lit.
g)	Flash point	32.0 °C (89.6 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 8.9 %(V) Lower explosion limit: 1.1 %(V)
k)	Vapour pressure	6 hPa (5 mmHg) at 20 °C (68 °F)
k) I)	Vapour pressure Vapour density	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6
k) l) m)	Vapour pressure Vapour density Relative density	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F)
k) l) m) n)	Vapour pressure Vapour density Relative density Water solubility	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble
k) I) m) n) o)	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available
k) I) n) o) p)	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water Auto-ignition temperature	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available 490.0 °C (914.0 °F) 480.0 °C (896.0 °F)
k) I) n) o) p) q)	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water Auto-ignition temperature Decomposition temperature	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available 490.0 °C (914.0 °F) 480.0 °C (896.0 °F) No data available
k) I) m) o) p) q) r)	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water Auto-ignition temperature Decomposition temperature Viscosity	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available 490.0 °C (914.0 °F) 480.0 °C (896.0 °F) No data available No data available
 k) l) m) n) o) p) q) r) s) 	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water Auto-ignition temperature Decomposition temperature Viscosity Explosive properties	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available 490.0 °C (914.0 °F) 480.0 °C (896.0 °F) No data available No data available No data available
 k) l) m) n) o) p) q) r) s) t) 	Vapour pressure Vapour density Relative density Water solubility Partition coefficient: n- octanol/water Auto-ignition temperature Decomposition temperature Viscosity Explosive properties Oxidizing properties	6 hPa (5 mmHg) at 20 °C (68 °F) 3.6 0.906 g/cm3 at 25 °C (77 °F) 0.05 g/l at 25 °C (77 °F) - slightly soluble No data available 490.0 °C (914.0 °F) 480.0 °C (896.0 °F) No data available No data available No data available No data available

Relative vapour density 3.6

9.2

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability

Stable under recommended storage conditions. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year. Stable under recommended storage conditions.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air. Vapours may form explosive mixture with air.

10.4 Conditions to avoid

May polymerize on exposure to light. Heat, flames and sparks.

- **10.5** Incompatible materials Oxidizing agents, Copper
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - > 6,000 mg/kg

LC50 Inhalation - Rat - 4 h - 12,000 mg/m3

LD50 Dermal - Rat - male and female - > 2,000 mg/kg

No data available

Skin corrosion/irritation

Skin - Rabbit Result: Skin irritation (OECD Test Guideline 404)

Serious eye damage/eye irritation

Eyes - Rabbit Result: Eye irritation - 24 h

Respiratory or skin sensitisation

Maximisation Test (GPMT) - Guinea pig Does not cause skin sensitisation. (OECD Test Guideline 406)

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects.

Carcinogenicity

This product is or contains a component that has been reported to be possibly carcinogenic based on its IARC, ACGIH, NTP, or EPA classification.

- IARC: 2B Group 2B: Possibly carcinogenic to humans (Styrene)
- NTP: Reasonably anticipated to be a human carcinogen (Styrene)
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Suspected of damaging the unborn child. Suspected human reproductive toxicant

Specific target organ toxicity - single exposure

No data available

Specific target organ toxicity - repeated exposure

Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

Additional Information

RTECS: WL3675000

Dermatitis, Central nervous system depression, Nausea, Dizziness, Headache, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Endocrine system. -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	NOEC - Pimephales promelas (fathead minnow) - 4 mg/l - 96 h
	LC50 - Pimephales promelas (fathead minnow) - 32 mg/l - 96 h
	LOEC - Pimephales promelas (fathead minnow) - 7.6 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 4.7 mg/l - 48 h (OECD Test Guideline 202)
Toxicity to algae	IC50 - Pseudokirchneriella subcapitata (green algae) - 1.4 mg/l - 72 h

12.2 Persistence and degradability

Biodegradability aerobic - Exposure time 28 d Result: > 60 % - Readily biodegradable

- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2055 Class: 3 Packing group: III Proper shipping name: Styrene monomer, stabilized Reportable Quantity (RQ): 1000 lbs

IMDG

UN number: 2055 Class: 3 Packing group: III EMS-No: F-E, S-D Proper shipping name: STYRENE MONOMER, STABILIZED

IATA

UN number: 2055 Class: 3 Packing group: III Proper shipping name: Styrene monomer, stabilized

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting levels establis	hed by SARA Title III,	Section 313:
	CAS-No.	Revision Date
Styrene	100-42-5	2007-07-01
SARA 311/312 Hazards Fire Hazard, Chronic Health Hazard		
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Styrene	100-42-5	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Styrene	100-42-5	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Styrene	100-42-5	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute toxicity
Acute aquatic toxicity
Carcinogenicity
Eye irritation
Flammable liquids
Flammable liquid and vapour.
Causes skin irritation.
Causes serious eye irritation.
Harmful if inhaled.
Suspected of causing cancer.
Suspected of damaging fertility or the unborn child.
Causes damage to organs through prolonged or repeated exposure.
Toxic to aquatic life.

HMIS Rating

0	
Health hazard:	1
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0

NFPA Rating

Health hazard:	2
Fire Hazard:	3
Reactivity Hazard:	0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.14

Revision Date: 12/02/2015

Print Date: 02/18/2016

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MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC. 150 Allen Road Suite 302 Basking Ridge, New Jersey 07920 Information: 1-800-416-2505 Emergency Contact: CHEMTREC 1-800-424-9300 Calls Originating Outside the US: 703-527-3887 (Collect Calls Accepted)

SUBSTANCE: TERT-BUTANOL

TRADE NAMES/SYNONYMS:

T-BUTANOL; 1,1-DIMETHYLETHANOL; TRIMETHYLCARBINOL; TRIMETHYLMETHANOL; TRIMETHYL METHANOL; BUTYL ALCOHOL; 2-METHYL-2-PROPANOL; TERT-BUTYL ALCOHOL; TRIMETHYL CARBINOL; UN 1120; C4H10O; 00230215; RTECS E01925000

CHEMICAL FAMILY: aliphatic, alcohols

CREATION DATE: Dec 01 2003 **REVISION DATE:** Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: TERT-BUTANOL CAS NUMBER: 75-65-0 PERCENTAGE: 100

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

EMERGENCY OVERVIEW: CHANGE IN APPEARANCE: hygroscopic COLOR: colorless PHYSICAL FORM: crystals, liquid ODOR: pungent odor MAJOR HEALTH HAZARDS: respiratory tract irritation, eye irritation, central nervous system depression PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:





INHALATION:
SHORT TERM EXPOSURE: irritation, nausea, vomiting, difficulty breathing, headache, drowsiness, dizziness, loss of coordination, blurred vision
LONG TERM EXPOSURE: no information on significant adverse effects
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
EYE CONTACT:
SHORT TERM EXPOSURE: irritation, blurred vision
LONG TERM EXPOSURE: irritation, blurred vision
LONG TERM EXPOSURE: irritation, blurred vision
LONG TERM EXPOSURE: irritation
SHORT TERM EXPOSURE: irritation
IONG TERM EXPOSURE: irritation
LONG TERM EXPOSURE: irritation
INGESTION:
SHORT TERM EXPOSURE: nausea, vomiting, diarrhea, stomach pain, headache, drowsiness, dizziness, loss of coordination, unconsciousness
LONG TERM EXPOSURE: no information on significant adverse effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: If a large amount is swallowed, get medical attention.

NOTE TO PHYSICIAN: For inhalation, consider oxygen.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive.

EXTINGUISHING MEDIA: alcohol-resistant foam, carbon dioxide, regular dry chemical, water

Large fires: Use alcohol-resistant foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Dike for later disposal. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. Withdraw immediately in case of rising sound from



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venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck, evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Do not scatter spilled material with high-pressure water streams. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas.

FLASH POINT: 52 F (11 C) (CC) LOWER FLAMMABLE LIMIT: 2.4% UPPER FLAMMABLE LIMIT: 8.0% AUTOIGNITION: 892 F (478 C) FLAMMABILITY CLASS (OSHA): IB

6. ACCIDENTAL RELEASE MEASURES

OCCUPATIONAL RELEASE:

Avoid heat, flames, sparks and other sources of ignition. Remove sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Keep unnecessary people away, isolate hazard area and deny entry. Stay upwind and keep out of low areas.

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS: TERT-BUTANOL: TERT-BUTYL ALCOHOL: 100 ppm (300 mg/m3) OSHA TWA 150 ppm (450 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993) 100 ppm ACGIH TWA 100 ppm (300 mg/m3) NIOSH recommended TWA 10 hour(s) 150 ppm (450 mg/m3) NIOSH recommended STEL

VENTILATION: Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.



EYE PROTECTION: Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

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CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.

1600 ppm

Any supplied-air respirator operated in a continuous-flow mode.

Any powered, air-purifying respirator with organic vapor cartridge(s).

Any air-purifying respirator with a full facepiece and an organic vapor canister.

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any self-contained breathing apparatus with a full facepiece.

Any supplied-air respirator with a full facepiece.

Emergency or planned entry into unknown concentrations or IDLH conditions -

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positivepressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressuredemand or other positive-pressure mode.

Escape -

Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.

Any appropriate escape-type, self-contained breathing apparatus.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid **COLOR:** colorless **CHANGE IN APPEARANCE:** hygroscopic **PHYSICAL FORM:** crystals, liquid **ODOR:** pungent odor **MOLECULAR WEIGHT:** 74.12 MOLECULAR FORMULA: (C-H3)3-C-O-H BOILING POINT: 180 F (82 C) **MELTING POINT:** 79 F (26 C) VAPOR PRESSURE: 31 mmHg @ 20 C VAPOR DENSITY (air=1): 2.6 SPECIFIC GRAVITY (water=1): 0.7887 WATER SOLUBILITY: soluble **PH:** Not available **VOLATILITY:** Not available **ODOR THRESHOLD:** 73 ppm



EVAPORATION RATE: 1.05 (butyl acetate=1) VISCOSITY: 3.3 cP @ 30 C COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available SOLVENT SOLUBILITY: Soluble: alcohol, ether, acetone, benzene

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat.

INCOMPATIBILITIES: metals, acids, oxidizing materials, combustible materials, metal salts

HAZARDOUS DECOMPOSITION:

Thermal decomposition products: oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

TERT-BUTANOL: IRRITATION DATA: 500 ul/24 hour(s) skin-rabbit mild; 100 ul/24 hour(s) eyes-rabbit severe TOXICITY DATA: >10000 ppm/4 hour(s) inhalation-rat LC50; >2 gm/kg skin-rabbit LD50; 2743 mg/kg oral-rat LD50 CARCINOGEN STATUS: ACGIH: A4 -Not Classifiable as a Human Carcinogen **LOCAL EFFECTS:** Irritant: inhalation, eye **ACUTE TOXICITY LEVEL:** Moderately Toxic: ingestion TARGET ORGANS: central nervous system MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: kidney disorders, liver disorders, respiratory disorders, skin disorders and allergies TUMORIGENIC DATA: Available. MUTAGENIC DATA: Available. **REPRODUCTIVE EFFECTS DATA:** Available. ADDITIONAL DATA: Alcohol may enhance the toxic effects.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA: FISH TOXICITY: 6410000 ug/L 96 hour(s) LC50 (Mortality) Fathead minnow (Pimephales promelas)



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INVERTEBRATE TOXICITY: 5504000 ug/L 48 hour(s) EC50 (Immobilization) Water flea (Daphnia magna)

OTHER TOXICITY: 2450000 ug/L 48 hour(s) LC50 (Mortality) Clawed toad (Xenopus laevis)

13. DISPOSAL CONSIDERATIONS

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

14. TRANSPORT INFORMATION

U.S. DOT 49 CFR 172.101: PROPER SHIPPING NAME: Butanols ID NUMBER: UN1120 HAZARD CLASS OR DIVISION: 3 PACKING GROUP: II LABELING REQUIREMENTS: 3



CANADIAN TRANSPORTATION OF DANGEROUS GOODS: SHIPPING NAME: Butanols UN NUMBER: UN1120 CLASS: 3 PACKING GROUP/CATEGORY: II

15. REGULATORY INFORMATION

<u>U.S. REGULATIONS:</u> CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4): Not regulated.

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C): ACUTE: Yes CHRONIC: No FIRE: Yes REACTIVE: No



SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65): TERT-BUTYL ALCOHOL

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

<u>STATE REGULATIONS:</u> California Proposition 65: Not regulated.

CANADIAN REGULATIONS: WHMIS CLASSIFICATION: Not determined.

<u>NATIONAL INVENTORY STATUS:</u> U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

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SAFETY DATA SHEET

Version 3.5 Revision Date 11/04/2015 Print Date 05/01/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers		
	Product name	:	<i>tert</i> -Butylbenzene
	Product Number	:	B90602
	Brand	:	Aldrich
	CAS-No.	:	98-06-6
1.2	Relevant identified uses of	f th	e substance or mixture and uses advised against
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
Telephone	:	+1 800-325-5832
Fax	:	+1 800-325-5052
Emergency telephone nur	nbe	er

1.4 Emergency telephone num

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 3), H226 Eye irritation (Category 2A), H319 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

GHS Label elements, including precautionary statements 2.2

Pictogram

Signal word



Warning

Hazard statement(s) H226 H319 H411	Flammable liquid and vapour. Causes serious eye irritation. Toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.

P264 P273	Wash skin thoroughly after handling. Avoid release to the environment
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P303 + P361 + P353	IF ON SKIN (or hair): Remove/ Take off immediately all contaminated clothing. Rinse skin with water/ shower.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
P391	Collect spillage.
P403 + P235	Store in a well-ventilated place. Keep cool.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: 2-Methyl-2-phenylpropane
Formula	: C ₁₀ H ₁₄
Molecular weight	: 134.22 g/mol
CAS-No.	: 98-06-6
EC-No.	: 202-632-4

Hazardous components

Component	Classification	Concentration
tert-Butylbenzene		
	Flam. Liq. 3; Eye Irrit. 2A; Aquatic Acute 2; Aquatic Chronic 2; H226, H319, H411	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

For small (incipient) fires, use media such as "alcohol" foam, dry chemical, or carbon dioxide. For large fires, apply water from as far as possible. Use very large quantities (flooding) of water applied as a mist or spray; solid streams of water may be ineffective. Cool all affected containers with flooding quantities of water.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up

Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Keep away from sources of ignition - No smoking. Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

Splash contact Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 480 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Impervious clothing, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type ABEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -58 °C (-72 °F) - lit.
f)	Initial boiling point and boiling range	169 °C (336 °F) - lit.
g)	Flash point	34.0 °C (93.2 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower	Lower explosion limit: 0.8 %(V)

flammability or explosive limits

- k) Vapour pressure No data available
- I) Vapour density No data available
- m) Relative density 0.867 g/cm3 at 25 °C (77 °F)
- n) Water solubility No data available
- o) Partition coefficient: n- log Pow: 3.80 octanol/water
- p) Auto-ignition 450.0 °C (842.0 °F) temperature
- q) Decomposition No data available temperature
- r) Viscosity No data available
- s) Explosive properties No data available
- t) Oxidizing properties No data available
- 9.2 Other safety information No data available

10. STABILITY AND REACTIVITY

- 10.1 Reactivity No data available
- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** Vapours may form explosive mixture with air.
- **10.4 Conditions to avoid** Heat, flames and sparks.
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 3,045 mg/kg Remarks: Behavioral:Somnolence (general depressed activity). Behavioral:Tremor. Gastrointestinal:Changes in structure or function of salivary glands.

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: CY9120000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC0 - Leuciscus idus	(Golden orfe) - 44 mg/	l - 48.0 h

LC50 - Leuciscus idus (Golden orfe) - 65 mg/l - 48.0 h

Toxicity to daphnia and LC50 - Daphnia magna (Water flea) - 41 mg/l - 24 h other aquatic invertebrates

- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US) UN number: 2709 Proper shipping name: Marine pollutant:yes Poison Inhalation Haza	Class: 3 Butyl benzenes ard: No	Packing group: III	
IMDG UN number: 2709 Proper shipping name: Marine pollutant:yes	Class: 3 BUTYLBENZENES	Packing group: III	EMS-No: F-E, S-D
IATA UN number: 2709 Proper shipping name:	Class: 3 Butylbenzenes	Packing group: III	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

tert-Butylbenzene	CAS-No. 98-06-6	Revision Date 1993-04-24
New Jersey Right To Know Components		
	CAS-No.	Revision Date
tert-Butylbenzene	98-06-6	1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids

H226	Flammable liquid and vapour.
H319	Causes serious eye irritation.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	2	
Chronic Health Hazard:		
Flammability:	3	
Physical Hazard	0	
NFPA Rating		
	-	
Health hazard:	2	
Health hazard: Fire Hazard:	2 3	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.5

Revision Date: 11/04/2015

Print Date: 05/01/2016

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SAFETY DATA SHEET

Version 4.11 Revision Date 10/29/2015 Print Date 03/03/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Tetrahydrofuran
	Product Number Brand Index-No.	:	401757 Sigma-Aldrich 603-025-00-0
	CAS-No.	:	109-99-9
1.2	Relevant identified uses of the substance or mixture and uses advised against		
	Identified uses	:	Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 631 USA	103
Telephone Fax	: +1 800-325-5832 : +1 800-325-5052	

1.4 **Emergency telephone number**

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable liquids (Category 2), H225 Acute toxicity, Oral (Category 4), H302 Eye irritation (Category 2A), H319 Carcinogenicity (Category 2), H351 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Signal word	Danger
Hazard statement(s) H225 H302 H319 H335 H351	Highly flammable liquid and vapour. Harmful if swallowed. Causes serious eye irritation. May cause respiratory irritation. Suspected of causing cancer.
Precautionary statement(s) P201 P202	Obtain special instructions before use. Do not handle until all safety precautions have been read and

	understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P233	Keep container tightly closed.
P240	Ground/bond container and receiving equipment.
P241	Use explosion-proof electrical/ventilating/lighting/equipment.
P242	Use only non-sparking tools.
P243	Take precautionary measures against static discharge.
P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P280	Wear protective gloves/ protective clothing/ eye protection/ face
	protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you
	feel unwell. Rinse mouth.
P303 + P361 + P353	IF ON SKIN (or hair): Take off immediately all contaminated clothing.
	Rinse skin with water/shower.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for
	breathing. Call a POISON CENTER or doctor/ physician if you feel
	unwell.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove
	contact lenses, if present and easy to do. Continue rinsing.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P337 + P313	If eye irritation persists: Get medical advice/ attention.
P370 + P378	In case of fire: Use dry sand, dry chemical or alcohol-resistant foam to
	extinguish.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P403 + P235	Store in a well-ventilated place. Keep cool.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS

May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Synonyms	: THF
Formula	: C ₄ H ₈ O
Molecular weight	: 72.11 g/mol
CAS-No.	: 109-99-9
EC-No.	: 203-726-8
Index-No.	: 603-025-00-0
Registration number	: 01-2119444314-46-XXXX

Hazardous components

Component	Classification	Concentration
Tetrahydrofuran		
	Flam. Liq. 2; Acute Tox. 4; Eye Irrit. 2A; Carc. 2; STOT SE 3; H225, H302, H319, H335, H351	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eve contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 **Extinguishing media**

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides

5.3 Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 **Further information**

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment, Avoid breathing vapours, mist or gas. Ensure adequate ventilation, Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 **Environmental precautions** Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Contain spillage, and then collect with an electrically protected vacuum cleaner or by wet-brushing and place in container for disposal according to local regulations (see section 13).

6.4 **Reference to other sections**

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place. Containers which are opened must be carefully resealed and kept upright to prevent leakage.

Dry residue is explosive. Store under inert gas. Test for peroxide formation periodically and before distillation. Storage class (TRGS 510): Flammable liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control	Basis
Tetrahydrofuran	109-99-9	TWA	50.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Central Nerv Upper Respi Kidney dama Confirmed a Danger of cu STEL	vous System impaii iratory Tract irritatio age nimal carcinogen v itaneous absorptio 100.000000 ppm	vith unknown relevance to humans n USA. ACGIH Threshold Limit Values (TLV)
		Central Nervous System impairment Upper Respiratory Tract irritation Kidney damage Confirmed animal carcinogen with unknown relevance to humans Danger of cutaneous absorption		
		TWĂ	200.000000 ppm 590.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		ST	250.000000 ppm 735.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	200.000000 ppm 590.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in mg/m3 is approximate.		

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological	Basis
Tetrahydrofuran	109-99-9	Tetrahydrofur an	2.0000 mg/l	Urine	ACGIH - Biological Exposure Indices (BEI)
	Remarks	End of shift (As soon as possible after exposure ceases)			

Derived No Effect Level (DNEL)

Application Area	Exposure routes	Health effect	Value
		1	
Workers	Skin contact	Long-term systemic effects	25mg/kg BW/d
Consumers	Skin contact	Long-term systemic effects	15mg/kg BW/d
Workers	Inhalation	Long-term local effects	150 mg/m3
Workers	Inhalation	Long-term systemic effects	150 mg/m3
Consumers	Inhalation	Long-term systemic effects	62 mg/m3
Consumers	Inhalation	Acute local effects	150 mg/m3
Consumers	Inhalation	Acute systemic effects	150 mg/m3

Predicted No Effect Concentration (PNEC)

Compartment	Value
Soil	2.13 mg/kg
Marine water	0.432 mg/l
Fresh water	4.32 mg/l
Marine sediment	2.33 mg/kg
Fresh water sediment	23.3 mg/kg
Onsite sewage treatment plant	4.6 mg/l

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact Material: butyl-rubber Minimum layer thickness: 0.3 mm Break through time: 18 min Material tested:Butoject® (KCL 897 / Aldrich Z677647, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	ether-like
c)	Odour Threshold	No data available
d)	рН	ca.7
e)	Melting point/freezing	Melting point/range: -108.44 °C (-163.19 °F) at 1.013.25 hPa (760.00

	point	mmHg)			
f)	Initial boiling point and boiling range	65.0 - 67.0 °C (149.0 - 152.6 °F) at 1,013.25 hPa (760.00 mmHg)			
g)	Flash point	-17.0 °C (1.4 °F) - closed cup			
h)	Evaporation rate	No data available			
i)	Flammability (solid, gas)	No data available			
j)	Upper/lower flammability or explosive limits	Upper explosion limit: 11.8 %(V) Lower explosion limit: 1.8 %(V)			
k)	Vapour pressure	170 hPa (128 mmHg) at 20.0 °C (68.0 °F)			
I)	Vapour density	ca.2.5 at 25 °C (77 °F) - (Air = 1.0)			
m)	Relative density	0.89 g/cm3			
n)	Water solubility	soluble			
o)	Partition coefficient: n- octanol/water	log Pow: 0.46			
p)	Auto-ignition temperature	215 °C (419 °F) at 1,013 hPa (760 mmHg)			
q)	Decomposition temperature	No data available			
r)	Viscosity	0.518 mm2/s at 25 °C (77 °F) - 0.403 mm2/s at 50 °C (122 °F) -			
s)	Explosive properties	Not explosive, In use may form flammable/explosive vapour-air mixture.			
t)	Oxidizing properties	The substance or mixture is not classified as oxidizing.			
Ot	Other safety information				

Relative vapour density ca.2.5 at 25 °C (77 °F) - (Air = 1.0)

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions. Test for peroxide formation before distillation or evaporation. Test for peroxide formation or discard after 1 year.

10.3 Possibility of hazardous reactions

Vapours may form explosive mixture with air.

10.4 Conditions to avoid Heat, flames and sparks.

- **10.5** Incompatible materials Strong oxidizing agents, Acids
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - 1,650 mg/kg

LC50 Inhalation - Rat - 6 h - 14.7 mg/l Remarks: Material may be irritating to mucous membranes and upper respiratory tract.

LD50 Dermal - Rat - > 2,000 mg/kg

No data available

Skin corrosion/irritation

Based on available data, the classification criteria are not met.

Serious eye damage/eye irritation

Eyes - Rabbit Result: Risk of serious damage to eyes. (Draize Test)

Respiratory or skin sensitisation

Based on available data, the classification criteria are not met.

Germ cell mutagenicity

In vivo tests did not show mutagenic effects

Ames test S. typhimurium Result: negative

Carcinogenicity

Suspected human carcinogens

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No toxicity to reproduction

Specific target organ toxicity - single exposure

May cause drowsiness or dizziness. - Nervous system May cause respiratory irritation.

Specific target organ toxicity - repeated exposure

The substance or mixture is not classified as specific target organ toxicant, repeated exposure.

Aspiration hazard

No aspiration toxicity classification

Additional Information

RTECS: LU5950000

Central nervous system depression, Cough, chest pain, Difficulty in breathing, Exposure to high airborne concentrations can cause anesthetic effects.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Pimephales promelas (fathead minnow) - 2,160 mg/l - 96 h
Toxicity to daphnia and other aquatic invertebrates	EC50 - Daphnia magna (Water flea) - 382 mg/l - 24 h
Toxicity to algae	Growth inhibition IC50 - Algae - 3,700 mg/l - 192 h

12.2 Persistence and degradability

Biodegradability

(OECD Test Guideline 301)

Remarks: According to the results of tests of biodegradability this product is not readily biodegradable.

12.3 Bioaccumulative potential

No bioaccumulation is to be expected (log Pow ≤ 4).

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

F DT/VF VD assessment not available as chemical safety assessment not rec

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2056 Class: 3 Proper shipping name: Tetrahydrofuran Reportable Quantity (RQ): 1000 lbs	Packing group: II	
Poison Inhalation Hazard: No		
IMDG UN number: 2056 Class: 3 Proper shipping name: TETRAHYDROFURAN	Packing group: II	EMS-No: F-E, S-D
IATA UN number: 2056 Class: 3 Proper shipping name: Tetrahydrofuran	Packing group: II	

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Fire Hazard, Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Tetrahydrofuran	109-99-9	1993-04-24
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Tetrahydrofuran	109-99-9	1993-04-24

New Jersey Right To Know Components

Tetrahydrofuran

CAS-No. 109-99-9 Revision Date 1993-04-24

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Carc.	Carcinogenicity
Eye Irrit.	Eye irritation
Flam. Liq.	Flammable liquids
H225	Highly flammable liquid and vapour.
H302	Harmful if swallowed.
H319	Causes serious eye irritation.
H335	May cause respiratory irritation.
H351	Suspected of causing cancer.
STOT SE	Specific target organ toxicity - single exposure

HMIS Rating

Health hazard:	1
Chronic Health Hazard:	*
Flammability:	3
Physical Hazard	0
NFPA Rating	
	~
Health hazard:	2
Health hazard: Fire Hazard:	2

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.11

Revision Date: 10/29/2015

Print Date: 03/03/2016

Thallium

SAFETY DATA SHEET

1 PRODUCT AND SUPPLIER IDENTIFICATION

Product Na	me: Tha	allium	Solid
i i ouuce iie		amuni	Jona

Formula: TI

Supplier:	ESPI Metals
	1050 Benson Way
	Ashland, OR 97520
Telephone:	800-638-2581
Fax:	541-488-8313
Email:	sales@espimetals.com
Emergency:	Infotrac 800-535-5053 (US) or 352-323-3500 (24 hour)
Recommended U	Jses: Scientific Research

2 HAZARDS IDENTIFICATION

GHS Classification (29 CFR 1910.1200): Acute toxicity - oral, category 2.

GHS Label Elements:



Signal Word: Danger

Hazard Statements: H300 Fatal if swallowed.

Precautionary Statements: P264 Wash hands thoroughly after handling, P270 Do not eat, drink or smoke when using this product, P301+P310 IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician, P330 Rinse mouth, P405 Store locked up, P501 Dispose of contents/container in accordance with local, state or federal regulations.

-

<u>3</u> COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient:	Thallium		
CAS#:	7440-28-0		
% :	100		
EC#:	231-138-1		

4 FIRST AID MEASURES

General Measures: Emergency responders should take care to avoid secondary exposure to thallium if it is present. Wear appropriate protective equipment.

INHALATION: Remove to fresh air, keep warm and quiet, give oxygen if breathing is difficult. Seek immediate medical attention. If mouth-to-mouth is necessary always use a barrier or bag-valve-mask device.

INGESTION: Rinse mouth with water. Do not induce vomiting. Seek immediate medical attention. Never induce vomiting or give anything by mouth to an unconscious person.

SKIN: Remove contaminated clothing, wash affected area with soap and water taking care not to break the skin and to cover all open wounds. Seek medical attention. Contaminated clothing should be safely contained and properly disposed of.

EYES: Flush eyes with lukewarm water, including under upper and lower eyelids, for at least 15 minutes. Seek medical attention immediately.

Most Important Symptoms/Effects, Acute and Delayed: Symptoms are usually delayed and include gastrointestinal distress and neurological symptoms. See section 11 for more information.

Indication of Immediate Medical Attention and Special Treatment: No other information available.

5 FIREFIGHTING MEASURES

Extinguishing Media: Use extinguishing media suitable for surrounding materials and type of fire.

Unsuitable Extinguishing Media: No further information available.

Specific Hazards Arising from the Material: Under fire conditions, thallium may release highly toxic fumes or gases.

Special Protective Equipment and Precautions for Firefighters: Full face, self-contained breathing apparatus and full protective clothing.

6 ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment, and Emergency Procedures: Wear appropriate respiratory and protective equipment specified in section 8. Isolate spill area and provide ventilation. Avoid breathing dust or fume. Avoid contact with skin and eyes. Eliminate all sources of ignition.

Methods and Materials for Containment and Cleaning Up: Scoop up or vacuum with a system utilizing a HEPA filtration system and place in properly labeled sealed containers. Special precautions must be taken when changing filters on HEPA vacuum cleaners used to clean up hazardous materials. Avoid creating dusts. Avoid contamination of air and water.

Environmental Precautions: Do not allow to enter drains or to be released to the environment.

7 HANDLING AND STORAGE

Precautions for Safe Handling: Wear appropriate respiratory and protective equipment specified in section 8. Only trained personnel should work with this product. Handle in a well-ventilated area. Avoid exposure to high temperature. Avoid breathing fumes. Avoid contact with skin and eyes. Wash thoroughly before eating or smoking.

Conditions for Safe Storage, Including Any Incompatibilities: Store under dry, inert gas such as argon, or can also be stored under deaerated water. Store in sealed unbreakable containers; the original labeled shipping container when possible. Store in an area that is cool, dry and temperature-controlled, away from direct sunlight, heat and ignition sources or where freezing is possible. Do not store together with acids, halogens or oxidizers. See section 10 for more information on incompatible materials.

8 EXPOSURE CONTROLS AND PERSONAL PROTECTION

Exposure Limits: Thallium (Soluble compounds, as TI)

OSHA/PEL: 0.1 mg/m³

ACGIH/TLV: 0.02 mg/m³(inhalable)

Appropriate Engineering Controls: Handle in an enclosed, controlled process under dry argon. Whenever possible the use of local exhaust ventilation, process enclosure or other engineering controls is the preferred method of controlling exposure to meet established occupational exposure limits. Use good housekeeping and sanitation practices. Do not use tobacco or food in work area. Wash thoroughly before eating or smoking. Clothing worn in areas of exposure to thallium dust or vapor should be restricted to the workplace and stored in special lockers.

Individual Protection Measures, Such as Personal Protective Equipment:

Respiratory Protection: When potential exposures are above the occupational limits, approved respirators must be used.

Eye Protection: Splash goggles or safety glasses.

Skin Protection: Wear impermeable gloves, protective work clothing as necessary.

9 PHYSICAL AND CHEMICAL PROPERTIES

Appearance:

- Form: Rod
- **Color**: Gray metallic
- Odor: Odorless

Odor Threshold:	Not determine	ed		
pH:		N/A		
Melting Point:		303.5	٥C	
Boiling Point:		1457±	±10	°C
Flash Point:		N/A		
Evaporation Rate:		N/A		
Flammability:		No dat	a	
Upper Flammable	Limit:	No dat	ta	
Lower Flammable	Limit:	No da	ta	
Vapor Pressure:		1 mm	Hg	@ 825 ^o C
Vapor Density:		N/A		
Relative Density (Specific Grav	ity):	11	.85 g/cc
Solubility in H ₂ O:		Insol	uble	2
Partition Coefficie	nt (n-octanol	/wate	r) :	Not determined
Autoignition Temp	perature:	No da	ta	
Decomposition Te	mperature:	No da	ta	
Viscosity:		N/A		

10 STABILITY AND REACTIVITY

Reactivity: No data

Chemical Stability: Stable under recommended storage conditions.

Possibility of Hazardous Reactions: High temperatures will generate toxic thallium oxide fumes.

Conditions to Avoid: Avoid high temperatures, reacts slowly with moist air.

Incompatible Materials: Oxidizing agents, strong acids, halogens, air and moisture.

Hazardous Decomposition Products: Thallium oxide fume.

11 TOXICOLOGICAL INFORMATION

Likely Routes of Exposure: Inhalation, skin and eyes.

Symptoms of Exposure: Abdominal pain and vomiting, extreme pain in the extremities, lethargy, hair loss.

Acute and Chronic Effects: Almost all of the available information refers to ingestion of thallium compounds, largely due to accidental ingestion, intentional poisoning and suicide attempts. Adverse reactions are dose dependent and occur in 3 stages. Massive doses may cause gastrointestinal distress (nausea, vomiting and abdominal pain) within 30 minutes but symptoms are usually delayed for 8 hours or longer. Gastrointestinal symptoms from smaller doses may
be delayed 24-48 hours. This is followed by neurological effects 2-5 days or even longer after ingestion, although it may occur as early as 12 hours after massive exposure. Other effects include hair loss, severe pain in the extremities, lethargy, ataxia, back pain, abnormal reflexes, neuropathy, muscle weakness, mental abnormalities, tremors, abnormal vision, headache, coma, convulsion, and death. There was no information available for exposure to thallium metal specifically rather than thallium compounds, and little conclusive information regarding exposure via inhalation.

Acute Toxicity: No data

Carcinogenicity: NTP: Not identified as carcinogenic IARC: Not identified as carcinogenic

To the best of our knowledge the chemical, physical and toxicological characteristics of the substance are not fully known.

12 ECOLOGICAL INFORMATION

Ecotoxicity: LC50 - Cyprinodon variegatus (sheepshead minnow) - 21.0 mg/l - 96.0 h

Persistence and Degradability: No data

Bioaccumulative Potential: No data

Mobility in Soil: No data

Other Adverse Effects: Do not allow material to be released to the environment. No further relevant information available.

13 DISPOSAL CONSIDERATIONS

Waste Disposal Method:

Product: Dispose of in accordance with Federal, State and Local regulations.

Packaging: Dispose of in accordance with Federal, State and Local regulations.

14 TRANSPORT INFORMATION

UN Number:	UN3288
UN Proper Shipping Name:	Toxic solid, inorganic, n.o.s. (Thallium)
Transport Hazard Class:	6.1
Packing Group:	II
Marine Pollutant:	Yes

15 REGULATORY INFORMATION

TSCA Listed: All components are listed.

Regulation (EC) No 1272/2008 (CLP): Acute toxicity - oral, category 2, Hazardous to the aquatic environment - acute hazard, category 3, Hazardous to the aquatic environment - chronic hazard, category 3.

Canada WHMIS Classification (CPR, SOR/88-66): Acute toxicity.

HMIS Ratings: Health: 3	Flammability: 0	Physical: 0
NFPA Ratings: Health: 3	Flammability: 0	Instability: 0

Chemical Safety Assessment: A chemical safety assessment has not been carried out.

16 OTHER INFORMATION

The information contained in this document is based on the state of our knowledge at the time of publication and is believed to be correct, but does not purport to be all inclusive and shall be used only as a guide. ESPI Metals makes no representation, warranty, or guarantee of any kind with respect to the information contained in this document or any use of the product based on this information. ESPI Metals shall not be held liable for any damages resulting from handling or from contact with the above product. Users should satisfy themselves that they have all current data relevant to their particular use.

Prepared by: ESPI Metals

Revised/Reviewed: July 2015

Safety Data Sheets (SDS)

SECTION 1-IDENTIFICATION

Product name: Toluene

Other names:-

Proper shipping name: Toluene

Recommended use of the chemical and restrictions on use:

The major use of toluene is as a mixture added to gasoline to improve octane ratings. Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners. Used in the manufacture of chemicals, dyes, explosives, benzoic acid. Some grades of toluene may contain traces of xylene and benzene. The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

WARNING: Intentional misuse by concentrating/inhaling contents may be lethal.

Manufacturer/Supplier Name: Taiwan SM Corp., Kaohsiung plant

Address: NO.7, Industrial 1st Rd, Lin-Yuan Kaohsiung County 83203, Taiwan, R.O.C. Phone No.: 886-7-6414511 Phone P

Emergency phone No./Fax No.: 886-7-6414511 Ext. 221 (on duty), 886-7-6414517 (off duty)/886-7-6423828

SECTION 2-HAZARDS IDENTIFICATION

GHS Classification:	
Flamm	nable Liquid Category 2
Acute	Toxicity (Oral) Category 4
Skin C	Corrosion/Irritation Category 2
Serio	is Eve Damage/ Eve Irritation Category 2
Specif	ic Target Organ Toxicity Repeated Exposure Category 2
Hazar	dous To The Aquatic Environment (Acute) Category 3
Aspir	abis 10 The Aquate Environment (Acute) Category 5
Aspire	
GHS Label elements:	
Hazard symbols	
Signal word	
0	Danger
Hazard statements	
	Highly flammable liquid and vapor
	Harmful if inhaled
	Causes skin irritation
	Causes serious eye irritation
	May cause damage to organs through prolonged or repeated exposure.
	May cause long lasting harmful effects to aquatic life.
	May be fatal if swallowed and enters airways.
Precautionary statements	, , , , , , , , , , , , , , , , , , ,
	Use only in well ventilated area.
	Control of exposure by mechanical ventilation in an unventilated or confined space
	Avoid breathing vanors and contact with skin and eves
	Wear breathing apparatus/protective gloves/face protection
	Store in well ventilated place
	Disposal must be in accordance with applicable federal state or local regulations
	Disposar must be in accordance with applicable rederal, state, or local regulations.

Other hazards: -

SECTION 3-COMPOSITION/INFORMATION ON INGREDIENTS

CAS No.	Chemical Name	wt% by weight	EINECS No.
00108-88-3	Toluene	97.0 min.	203-625-9
Synonyms	Methylbenzol: Methylbenzene: Tol	uol: Phenylmethane	

SECTION 4-FIRST AID MEASURES

Description of necessary first aid measures

Eye:

- 1. Flush immediately with warm water for at least 20 minutes.
- 2. Ensure complete irrigation of the eye by keeping eyelids apart and away from eye and moving the eyelids by occasionally lifting the upper and lower lids.
- 3. If pain persists or recurs seek medical attention.
- 4. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin:

- 1. Removing contaminated clothing, shoes, and leathery wearings, cleaning procedure is available before reused or waste treatment.
- 2. Washing affected area thoroughly with soap and water for at least 20 minutes.
- 3. Call a Physician if irritation develops or persists.

Ingestion:

- 1. If spontaneous vomiting appears imminent or occurs, hold patient's head down, lower than their hips to help avoid possible aspiration of vomits.
- 2. If victim is conscious and alert, give $2 \sim 4$ cupfuls of milk/water to dilute the substance in stomach.
- 3. Never give anything by mouth to an unconscious person.
- 4. Don't induce vomiting unless directed to do so by medical person.
- 5. If vomiting occurs, lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration.
- 6. Then seek for medical attention.

Inhalation:

- 1. Remove from further exposure and flush thoroughly with air.
- 2. Lay patient down. Keep warm and rested.
- 3. Prostheses such as false teeth, which may block airway, should be removed, where possible, prior to initiating first aid procedures.
- 4. If respiratory irritation, seek immediate medical assistance and call a physician.

Most important symptoms/effects, acute and delayed

Headache, fatigue, drowsiness, insomnia, anorexia and pain in limbs, nervousness, impairment of memory.

Indication of immediate medical attention and special treatment needed, if necessary

For acute or short term repeated exposures to toluene:

Inhalation:

- 1. Inhalation overexposure can produce toxic effects. Monitor for respiratory distress.
- 2. If cough or difficulty in breathing develops, evaluate for upper respiratory tract inflammation, bronchitis, and pneumonitis. Administer supplemental oxygen with assisted ventilation, as required.
- 3. This material (or a component) sensitizes the heart to the effects of sympathomimetic amines. Epinephrine and other sympathomimetic drugs may initiate cardiac arrhythmias in individuals exposed to this material.
- 4. Administration of sympathomimetic drugs should be avoided.

Ingestion:

- 1. If ingested, this material presents a significant aspiration and chemical pneumonitis hazard.
- 2. Induction of emesis is not recommended.
- 3. Consider activated charcoal and/or gastric lavage.
- 4. If patient is obtunded, protect the airway by cuffed endotracheal intubation or by placement of the body in a Trendelenburg and left lateral decubitus position.

SECTION 5-FIRE FIGHTING MEASURES

Extinguishing media

Foam \sim CO₂ \sim Dry chemical \sim Water fog.

Specific hazards arising from the chemical

- 1. Liquid and vapor are highly flammable.
- 2. Severe fire hazard when exposed to heat, flame and/or oxidizers.
- 3. Vapor may travel a considerable distance to source of ignition.
- 4. Heating may cause expansion or decomposition leading to violent rupture of containers.
- 5. On combustion, may emit toxic fumes of carbon monoxide (CO).

Special protective equipment and precautions for fire-fighters

- 1. Firefighters must use full bunker gear including NIOSH-approved positive pressure self-contained breathing apparatus to protect against potential hazardous combustion or decomposition products and oxygen deficiencies.
- 2. Evacuate area and fight the fire from a maximum distance or use unmanned hose holders or monitor nozzles.
- 3. Cover pooling liquid with foam.
- 4. Containers can build pressure if exposed to radiant heat; cool adjacent containers with flooding quantities of water until well after the fire is out.
- 5. Withdraw immediately from the area if there is a rising sound from a venting safety device or discoloration of vessels, tanks, or pipelines.
- 6. Be aware that burning liquid will float on water.
- 7. Notify appropriate authorities of potential fire and explosion hazard if liquid enter sewers or waterways

SECTION 6-ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedure

- 1. Personal protective equipment (specified in Section 8)
 - Eyes : Chemical safety goggles are recommended, and a face shield is added when needed.
 - Skin : Wear appropriate protective gloves to avoid skin contact.
 - Clothing: When direct contact is likely, use rubberized clothings, apron and boots.
 - Respiratory : When limits are exceeded, wear a respirator approved by NIOSH/MSHA for protection against organic dust, mists and vapors.
- 2. Remove all sources of ignition. No smoking, naked lights or ignition sources. Ventilate area of leak or spill.
- 3. Keep unnecessary and unprotected personnel from entering. Evacuate personnel from the danger area. Consult with an expert about the emergency procedures.

Environmental precautions

- 1. Prevent spillage from entering drains, surface, and groundwater.
- 2. Contain and recover liquid when possible. Use non-sparking tools and equipment.
- 3. Collect liquid in an appropriate container or absorb with an inert material (e.g. vermiculite, dry sand, earth), and place in a chemical waste container.
- 4. Report the accidental spill/release to Local/State government.

Methods and materials for containment and cleaning up

Minor spill:

- 1. Remove all ignition sources.
- 2. Clean up all spills immediately.
- 3. Avoid breathing vapors and contact with skin and eyes.
- 4. Control personal contact by using protective equipment.
- 5. Contain and absorb small quantities with vermiculite or other absorbent material.
- 6. Wipe up.
- 7. Collect residues in a flammable waste container.

Major spill

- 1. Clear area of personnel and move upwind.
- 2. Alert emergency responders and tell them location and nature of hazard.
- 3. May be violently or explosively reactive.
- 4. Wear breathing apparatus plus protective gloves.
- 5. Prevent spillage from entering drains or water course.
- 6. No smoking, naked lights or ignition sources. Increase ventilation.
- 7. Stop leak if safe to do so.
- 8. Water spray or fog may be used to disperse/absorb vapor.
- 9. Contain spill with sand, earth or vermiculite.
- 10. Use only spark-free shovels and explosion proof equipment.
- 11. Collect recoverable product into labeled containers for recycling...
- 12. Absorb remaining product with sand, earth or vermiculite.
- 13. Collect solid residues and seal in labeled drums for disposal.
- 14. Wash area and prevent runoff into drains.
- 15. If contamination of drains or waterways occurs, advise emergency services.

SECTION 7-HANDLING AND STORAGE

Precautions for safe handling

- 1. Wash thoroughly after handling.
- 2. Use only in well ventilated area.
- 3. Ground and bond containers when transferring.
- 4. Use spark-free tools and explosion proof equipment.
- 5. Empty containers retain product residue (liquid/vapor), and can be dangerous.
- 6. Do not pressurize, cut, weld, braze, solder, drill, or expose empty containers to heat, sparks or open flames.

Conditions for safe storage, including any incompatibilities

- 1. Store in original containers in approved flame-proof area.
- 2. No smoking, naked lights, heat or ignition sources.
- 3. DO NOT store in pits, depressions, basements or areas where vapors may be trapped.
- 4. Keep containers securely sealed.
- 5. Store away from incompatible materials in a cool, dry well ventilated area.
- 6. Protect containers against physical damage and check regularly for leaks.
- 7. Keep containers tightly closed and store in a cool, dry, well-ventilated place, plainly labeled, and out of closed vehicles.
- 8. Ground all equipment containing this material.
- 9. Observe manufacturer's storing and handling recommendations.
- 10. Containers should be able to withstand pressures expected from warming and cooling in storage. This flammable liquid should be stored in a separate safety cabinet or room. A refrigerated room is preferable for materials with a flash point temperature lower than 70°F (21°C).

SECTION 8-EXPOSURE CONTROLS, PERSONAL PROTECTION

OSHA - Final PELs : 200 ppm TWA. OSHA Ceiling : 300ppm.

ACGIH : 50 ppm, skin -potential forcutaneous absorption. NIOSH : 100 ppm TWA; 375 mg/m³ TWA; 500 ppm IDLH. Taiwan TWA : 100 ppm (skin). Taiwan STEL : 125 ppm (skin). Taiwan Ceiling : -----. Taiwan BEI : 1 mg/l (before on duty).

Engineering control

- 1. Process should be located at least 17 meter (50 feet) away from open flames and all high temperature operations likely to cause ignition of the styrene monomer vapor.
- 2. In venting styrene monomer vapors, consideration should be given to possible halogenation of the vapors by low concentrations of free chlorine and bromine with the resultant formation of lacrimations.
- Process should be designed so that the operator is not exposed to direct contact with Toluene or the vapor. The technical
 problems of designing equipment, providing adequate ventilation and operating procedures which promise maximum
 security and economy, can best be handled by competent engineers.
- 4. It is essential for safety that equipment be used and maintained as recommended by the manufacturer.
- 5. Tanks used to store or process Toluene should be closed vessels vented to a safe point of discharge in the outside atmosphere away from operating stations, roadways, and at least 17 meter (50 feet) from possible sources of ignitions. All sparks, flames, heated surface, or other sources of ignition should be kept away from all vents. It is advisable, to provide suction on vessels when inspection or observation openings are made, to minimize or eliminate escape of vapors.

Personal protective equipment

Eye Protection:

Safety glasses equipped with side shields are recommended as minimum protection in industrial settings. Chemical goggles should be worn during transfer operations or when there is a likelihood of misting, splashing, or spraying of this material. A suitable emergency eye wash water and safety shower should be located near the work station.

Skin protection:

Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Clothing:

Avoid skin contact. Wear long-sleeved fire-retardant garments (e.g., Nomex®) while working with flammable and combustible liquids. Additional chemical-resistant protective gear may be required if splashing or spraying conditions exist. This may include an apron, boots and additional facial protection. If product comes in contact with clothing, immediately remove soaked clothing and shower. Promptly remove and discard contaminated leather goods.

Respirators:

For known vapor concentrations above the occupational exposure guidelines (see below), use a NIOSH-approved organic vapor respirator if adequate protection is provided. Protection factors vary depending upon the type of respirator used. Respirators should be used in accordance with OSHA requirements (29 CFR 1910.134). For airborne vapor concentrations that exceed the recommended protection factors for organic vapor respirators, use a full-face, positive-pressure, supplied air respirator. Due to fire and explosion hazards, do not enter atmospheres containing concentrations greater than 10% of the lower flammable limit of this product.

SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Transparent liquid	Upper/lower explosive limits : $1.2\% \sim 7.1\%$
Odour : pleasant aromatic petroleum odour	Vapor Pressure : 22 mmHg @20°C/68°F
Odour threshold : $0.16 \sim 37$ ppm (detect)	Vapor Density : 3.1 (air=1)
$1.9 \sim 69$ ppm (recognition)	
PH : Not available	Relative density : 0.86 (water=1)
Melting/Freezing Point : -95 °C	Solubility in water : $54 \sim 58 \text{ mg}/100 \text{ ml}$
Initial boiling point/boiling range : 110.6 °C	Partition coefficient : 2.73 (n-octanol/water)
Flash point : 4.4 $^{\circ}$ C (closed cup)	Auto-ignition temperature : 480°C
Evaporation Rate : 2.24 (BuAc=1)	Decomposition temperature : Not available
Flammability (solid/gas) : Not available	Viscosity : 0.6 mPa.s max @20°C
Molecular Formula : C ₆ H ₅ CH ₃	Molecular Weight : 92.056

SECTION 10-STABILITY AND REACTIVITY

Reactivity

Vapor is explosive when exposed to heat or flame

Chemical stability

Stable at room temperature in closed containers under normal storage and handling conditions.

Possibility of hazardous reaction

Has not been reported.

Condition to avoid

Product is highly flammable – Keep away from sources of ignition. Avoid the higher temperatures. Keep away from open fire, heating elements and heat radiating surface and prevent from forming of the vapours mixtures with air in explosion limits.

Incompatible materials

Heat, flame, strong oxidizers, nitric and sulfuric acids, chlorine, nitrogen tetraoxide; will attack some forms of plastics, rubber, coatings.

Hazardous decomposition products

Carbon monoxide, carbon dioxide, hydrocarbons.

SECTION 11-TOXICOLOGICAL INFORMATION

Routes of exposure Eye, Skin, inhalation, Ingestion.

Symptoms (treatments as indicated in Section 4)

Eye: The liquid produces a high level of eye discomfort and is capable of causing pain and severe conjunctivitis. Corneal injury may develop, with possible permanent impairment of vision, if not promptly and adequately treated. There is evidence that material may produce eye irritation in some persons and produce eye damage 24 hours or more after instillation. Severe inflammation may be expected with pain. There may be damage to the cornea. Unless treatment is prompt and adequate there may be permanent loss of vision. Conjunctivitis can occur following repeated exposure.

Skin: Contact with the material may damage the health of the individual; systemic effects may result following absorption. The material may cause moderate inflammation of the skin either following direct contact or after a delay of some time. Repeated exposure can cause contact dermatitis which is characterized by redness, swelling and blistering. Entry into the blood-stream, through, for example, cuts, abrasions or lesions, may produce systemic injury with harmful effects. Examine the skin prior to the use of the material and ensure that any external damage is suitably protected.

Ingestion: Accidental ingestion of the material may be harmful; animal experiments indicate that ingestion of less than 150 gram may be fatal or may produce serious damage to the health of the individual. Swallowing of the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis; serious consequences may result. (ICSC13733). Considered an unlikely route of entry in commercial/industrial environments. The liquid may produce gastrointestinal discomfort and may be harmful if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Inhalation: Inhalation of vapours or aerosols (mists, fumes), generated by the material during the course of normal handling, may be damaging to the health of the individual. There is some evidence to suggest that the material can cause respiratory irritation in some persons. The body's response to such irritation can cause further lung damage. Inhalation of vapours may cause drowsiness and dizziness. This may be accompanied by sleepiness, reduced alertness, loss of reflexes, lack of co-ordination, and vertigo. Inhalation of high concentrations of gas/vapour causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death. The use of a quantity of material in an unventilated or confined space may result in increased exposure and an irritating atmosphere developing. Before starting consider control of exposure by mechanical ventilation.

Chronic exposure: There has been some concern that this material can cause cancer or mutations but there is not enough data to make an assessment. Substance accumulation, in the human body, may occur and may cause some concern following repeated or long-term occupational exposure.

Toxicity LD50: <870 mg/kg (rat, oral) LC50: 6000 ppm/6h (rat, inhalation)

Chronic effect Carcinogenicity: ACGIH : A4-Not classifiable as a Human Carcinogen. OSHA : Possible select carcinogen. IARC : Group 3 carcinogen.

Epide miology: Not available.

Teratogenicity: Teratogenic effects have occurred in experimental animals.

Reproductive Effects: Adverse reproductive effects have occurred in experimental animals.

Neurotoxicity: Not available.

Mutagenicity: Not available.

SECTION 12-ECOLOGICAL INFORMATION

Ecotoxicity

 LC_{50} (96 hr.) Fish: 7.3~22.8 mg/l EC₅₀ (48 hr.) Water flea: -Biocencentration factor (BCF): 1.67~380

Persistence and degradability

- 1. The material are expected to form a slick on the surface of waters after release in calm sea conditions. This is expected to evaporate and enter the atmosphere where it will be degraded through reaction with hydroxyl radicals.
- 2. Some of the material will become associated with benthic sediments, and it is likely to be spread over a fairly wide area of sea floor. Marine sediments may be either aerobic or anaerobic. The material, in probability, is biodegradable, under aerobic conditions. Evidence also suggests that the hydrocarbons may be degradable under anaerobic conditions although such degradation in benthic sediments may be a relatively slow process.
- 3. Under aerobic conditions the material will degrade to water and carbon dioxide, while under aerobic processes it will produce water, methane, carbon dioxide and carbon dioxide.
- 4. Based on test results, as well as theoretical considerations, the potential for bioaccumulation may be high. Toxic effects are often observed in species such as blue mussel, daphnia, freshwater green algae, marine copepods and amphipods.

Half-life (Air): $10 \sim 104$ hr Half-life (Surface water): $96 \sim 528$ hr Half-life (Ground water): $168 \sim 672$ hr Half-life (Soil): $96 \sim 528$ hr

Bioaccumulative potential

This material is not expected to significantly bioaccumulate.

Mobility in soil: -

Other adverse effects: -

SECTION 13-DISPOSAL CONSIDERATIONS

Residues and spilled material are hazardous waste due to ignitability. Disposal must be in accordance with applicable federal, state, or local regulations.

The container for this product can present explosion or fire hazards, even when emptied. To avoid risk of injury, do not cut, puncture, or weld on or near this container. Since the emptied containers retain product residue, follow label warnings even after container is emptied.

SECTION 14-TRANSPORTATION INFORMATION

		T. 1		
	Shipping Name	Toluene		
US DOT	Hazard Class	3	Hazard Labels	1204
03 001	UN Number	1294		3
	Packing Group	II		
	Shipping Name	Toluene		
	Hazard Class	3.2		
	UN Number	1294		
Sea(IMO/IMDG)	Packing Group	II	Hazard Labels	
	IMDG Code Page	3285		
	MARPOL	Not a DOT "Marine Pollutant" per 49 CFR 171.8.		
	Shipping Name	Toluene		
	Hazard Class	3.2	Hazard Labala	1
AII(ICAO/IAIA)	Subsidiary Class	1294	Hazard Labers	
	Packing Group	II		
RID/ ADR	No information availa	able.		
	Shipping Name	Toluene		
	Hazard Class	3		
Canadian TDG	UN Number	1294	Hazard Labels	1294
	Packing Group	II		3
	Subsidiary Class	9.2		

SECTION 15-REGULATORY INFORMATION

US FEDERAL
TSCA
CAS# 108-88-3 is listed on the TSCA inventory.
Health & Safety Reporting List
CAS# 108-88-3: Effective Date: 10/4/82; Sunset Date: 10/4/92
Chemical Test Rules
None of the chemicals in this product are under a Chemical Test Rule.
Section 12b
None of the chemicals are listed under TSCA Section 12b.
TSCA Significant New Use Rule
None of the chemicals in this material have a SNUR under TSCA.
SARA
Section 302 (RQ)
CAS# 108-88-3 : final RQ = 1000 pounds (454 kg)
Section 302 (TPQ)
None of the chemicals in this material have a TPQ.
SARA Codes
CAS# 108-88-3 : acute, flammable.
Section 313
This material contains Toluene (CAS# 108-88-3, 99% & 100%), which is subject to the reporting requirements of
Section 313 of SARA Title III and 40 CFR Part 372.
Clean Air Act
CAS# 108-88-3 is listed as a hazardous air pollutant (HAP).
This material does not contain any Class 1 Ozone depletors.
This material does not contain any Class 2 Ozone depletors.

Clean W	Vater Act
	CAS# 108-88-3 is listed as a Hazardous Substance under the CWA.
	CAS# 108-88-3 is listed as a Priority Pollutant under the Clean Water Act.
	CAS# 108-88-3 is listed as a Toxic Pollutant under the Clean Water Act.
OSHA	
	None of the chemicals in this product are considered highly hazardous by OSHA.
STATE	
Toluene	can be found on the following state right to know lists: California, New Jersey, Florida, Pennsylvania, Minnesota,
Massach	usetts.
WARNI	NG: This product contains Toluene, a chemical known to the state of California to cause birth defects or other
	reproductive harm.
Californ	ia No Significant Risk Level: None of the chemicals in this product are listed.
Europea	n/International Regulations
Europea	n Labeling in Accordance with FC Directives
Luiopea	Hazard Symbols: YN F
	Disk Dhracas · D 10 Elemmable
	P 20 Hormful by inhelation
	N 20 Hammu by minimum. Safaty Dhrasas · S 0 Kaan container in a wall vantilated place
	Safety Finases . 5.7 Keep container in a wen-ventilated place.
	S 10 Reep away noili sources of Ignition - No shoking.
	S 20 Da nationativinte decina
	S 29 Do not empty into drains.
	S 33 Take precautionary measures against static discharges.
WGK (M	(ater Danger/Protection)
TT 1 1 TZ	CAS# 108-88-3: 2
United K	ingdom Occupational Exposure Limits
	CAS# 108-88-3: OES-United Kingdom, TWA 50 ppm TWA; 191 mg/m3 TWA.
	CAS# 108-88-3: OES-United Kingdom, STEL 150 ppm STEL; 574 mg/m3 STEL.
CANAL	
	CAS#100-42-5 is listed on Canada's DSL/NDSL list.
	This product has a WHMIS classification of B2, D2A (99%)/B3, D2A (100%).
	CAS# 105-05-5 is not listed on Canada's Ingredient Disclosure List.
Exposur	e Limits
	 CAS# 108-88-3: OEL-AUSTRALIA:TWA 100 ppm (375 mg/m3);STEL 150 ppm (560 mg/m3)
	 OEL-BELGIUM:TWA 100 ppm (377 mg/m3);STEL 150 ppm (565 mg/m3)
	 OEL-CZECHOSLOVAKIA:TWA 200 mg/m3;STEL 1000 mg/m3
	 OEL-DENMARK:TWA 50 ppm (190 mg/m3);Skin
	 OEL-FINLAND:TWA 100 ppm (375 mg/m3);STEL 150 ppm; Skin
	 OEL-FRANCE:TWA 100 ppm (375 mg/m3);STEL 150 ppm (560 mg/m3)
	 OEL-GERMANY:TWA 100 ppm (380 mg/m3)
	 OEL-HUNGARY:TWA 100 mg/m3;STEL 300 mg/m3;Skin
	 OEL-JAPAN:TWA 100 ppm (380 mg/m3)
	 OEL-THE NETHERLANDS:TWA 100 ppm (375 mg/m3);Skin
	 OEL-THE PHILIPPINES:TWA 100 ppm (375 mg/m3)
	 OEL-POLAND:TWA 100 mg/m3
	 OEL-RUSSIA:TWA 100 ppm; STEL 50 mg/m3
	 OEL-SWEDEN: TWA 50 ppm (200 mg/m3); STEL 100 ppm (400 mg/m3); Skin
	 OEL-SWITZERLAND:TWA 100 ppm (380 mg/m3):STEL 500 ppm
	• OEL-THAILAND:TWA 200 ppm: STEL 300 ppm
	 OEL-TURKEY:TWA 200 ppm (750 mg/m3)
	 OEL-UNITED KINGDOM TWA 100 nnm (375 mg/m3) STEL 150 nnm Skin OFL IN
	BULGARIA COLOMBIA IORDAN KORFA check ACGIH TI V OFL IN NEW 7FAI AND
	SINGAPORE. VIETNAM check ACGI TLV

SECTION 16-OTHER INFORMATION

References and sources

- 1. CHEMINFO Data Bank, CCINFO CD, 2005-3
- HAZARD TEXT Data Bank, TOMES PLUS CD, Vol
 RETECS Data Bank, TOMES CPS CD, Vol.65, 2005 HAZARD TEXT Data Bank, TOMES PLUS CD, Vol.65, 2005
- 4. HSDB Data Bank, TOMES CPS CD, Vol.65, 2005
- 5. Hazardous Substance Data Bank, Environment Protection, Administration, Executive Yuan, ROC (Taiwan)
- 6. 7. Chemwatch Data Bank, 2005-1

SDS, GHS in Taiwan, Council of Labor Affairs, Executive Yuan, ROC (Taiwan)

7. DDD, 0110	in full and counter of	Eusor mining, Excentive muni, ite e (minin)
Version	Date	Remark
Version 1	06/01/1998	Original Version.
Version 2	04/20/2001	Updated 10 sections to 16 sections.
Version 3	08/01/2003	Updated "SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES".
Version 4	01/01/2006	Updated "SECTION 14-TRANSPORTATION INFORMATION".
Version 5	08/05/2008	Updated each section by GHS SDS.
Prepared by	Safety & Environmen	t Protection Section, Taiwan SM Corporation Kaohsiung Plant.



SAFETY DATA SHEET

Issuing Date 03-Nov-2015

Revision Date 21-Jul-2015

Revision Number 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier Product Number Product Name Synonyms

601 Total Petroleum Hydrocarbons (TPH) in Water #2 None

Recommended use of the chemical and restrictions on useRecommended UseLaboratory use onlyUses advised againstNo information available

Details of the supplier of the safety of	data sheet
Supplier	ERA a Waters Company
Supplier Address	16341 Table Mountain Parkway, Golden, CO 80403 USA
Non-Emergency Telephone Number	+1-303-431-8454
Supplier Email	sdsinfo@waters.com
Emergency telephone number	
Company Emergency Phone	In case of EMERGENCY call CHEMTREC Day or Night
Number	Within USA and Canada: 800-424-9300
	International Call Collect: +1-703-527-3887

2. HAZARDS IDENTIFICATION

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Skin corrosion/irritation	Category 1
Serious eye damage/eye irritation	Category 1

GHS Label elements, including precautionary statements

Odor Odorless

Do not breathe dust/fume/gas/mist/vapors/spray

Wash face, hands and any exposed skin thoroughly after handling

Wear protective gloves/protective clothing/eye protection/face protection

Precautionary Statements - Response

Immediately call a POISON CENTER or doctor/physician

Specific treatment (see supplemental first aid instructions on this label)

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing Immediately call a POISON CENTER or doctor/physician

Skin

IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower Wash contaminated clothing before reuse

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing Immediately call a POISON CENTER or doctor/physician

Ingestion

IF SWALLOWED: Rinse mouth. DO NOT induce vomiting

Precautionary Statements - Storage Store locked up Precautionary Statements - Disposal Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

Not applicable <u>Unknown Toxicity</u> 0 % of the mixture consists of ingredient(s) of unknown toxicity <u>Other information</u>

No information available Interactions with Other Chemicals No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Note: only the components contributing to the product's GHS hazard classification are listed in this section.

Chemical Name	CAS-No	Percent
Hydrochloric Acid	7647-01-0	0.09

4. FIRST AID MEASURES

First aid measures

General Advice	Immediate medical attention is required. Show this safety data sheet to the doctor in attendance.
Eye contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Keep eye wide open while rinsing. Do not rub affected area. Remove contact lenses, if present and easy to do. Continue rinsing. Seek immediate medical attention/advice.
Skin contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Seek immediate medical attention/advice.
Inhalation	Remove to fresh air. If breathing has stopped, give artificial respiration. Get medical attention immediately. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. If breathing is difficult, (trained personnel should) give oxygen. Delayed pulmonary edema may occur. Get medical attention immediately if symptoms occur.
Ingestion	Do NOT induce vomiting. Rinse mouth immediately and drink plenty of water. Never give anything by mouth to an unconscious person. Call a physician or poison control center immediately.
Self-protection of the first aider	Ensure that medical personnel are aware of the material(s) involved, take precautions to protect themselves and prevent spread of contamination. Avoid contact with skin, eyes or clothing. Avoid direct contact with skin. Use barrier to give mouth-to-mouth resuscitation. Use personal protective equipment as required. Wear personal protective clothing (see section 8).
Most important symptoms and eff	ects, both acute and delayed

Most Important Symptoms and Burning sensation. Effects Indication of any immediate medical attention and special treatment needed

Notes to Physician

Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated. Do not give chemical antidotes. Asphyxia from glottal edema may occur. Marked decrease in blood pressure may occur with moist rales, frothy sputum, and high pulse pressure.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media

Use extinguishing measures that are appropriate to local circumstances and the surrounding environment. **Unsuitable Extinguishing Media** CAUTION: Use of water spray when fighting fire may be inefficient. Specific hazards arising from the chemical The product causes burns of eyes, skin and mucous membranes. Thermal decomposition can lead to release of irritating gases and vapors. **Uniform Fire Code** Corrosive: Other--Liquid **Hazardous Combustion Products** Carbon oxides. Explosion Data Sensitivity to Mechanical Impact No. Sensitivity to Static Discharge No. Protective equipment and precautions for firefighters As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal precautions Other Information <u>Environmental precautions</u>	Attention! Corrosive material. Avoid contact with skin, eyes or clothing. Ensure adequate ventilation. Use personal protective equipment as required. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Refer to protective measures listed in Sections 7 and 8.	
Environmental precautions	Refer to protective measures listed in Sections 7 and 8. Prevent further leakage or spillage if safe to do so. Should not be released into the environment. Do not allow to enter into soil/subsoil. Prevent product from entering drains.	
methods and material for containme	nt and cleaning up	
Methods for containment Methods for cleaning up	Prevent further leakage or spillage if safe to do so. Pick up and transfer to properly labeled containers. Soak up with inert absorbent material.	

7. HANDLING AND STORAGE

Precautions for safe handling

Handling	Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. In case of insufficient ventilation, wear suitable respiratory equipment. Use only with adequate ventilation and in closed systems. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse.
Conditions for safe storage, including	ng any incompatibilities
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Protect from moisture. Store locked up. Keep out of the reach of children. Store away from other materials.
Incompatible Products	Acids. Bases. Oxidizing agent.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines	This product, as supplied, does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies		
Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Hydrochloric Acid 7647-01-0	Ceiling: 2 ppm	(vacated) Ceiling: 5 ppm (vacated) Ceiling: 7 mg/m ³ Ceiling: 5 ppm Ceiling: 7 mg/m ³	IDLH: 50 ppm Ceiling: 5 ppm Ceiling: 7 mg/m ³
Other Exposure Guidelines	Vacated limits revoked by the Court of Appeals decision in AFL-CIO v. OSHA, 965 F.2d 962 (11th Cir., 1992)		
Appropriate engineering controls			
Engineering Measures	Showers Eyewash stations Ventilation systems		
Individual protection measures, suc	ch as personal protective equi	<u>pment</u>	
Eye/face protection	Face protection shield.		
Skin and body protection	Wear protective gloves and pro apron. Impervious gloves.	otective clothing. Long sleeved	clothing. Chemical resistant
Respiratory protection	No protective equipment is nee exceeded or irritation is experie	eded under normal use condition enced, ventilation and evacuation	ns. If exposure limits are
Hygiene Measures	Handle in accordance with good skin, eyes or clothing. Wear su smoke when using this produce Contaminated work clothing sh of equipment, work area and c immediately after handling the contaminated protective equipment	od industrial hygiene and safety iitable gloves and eye/face prote t. Take off contaminated clothin nould not be allowed out of the v lothing is recommended. Wash product. For environmental pro ment before re-use.	practice. Avoid contact with ection. Do not eat, drink or ig and wash before reuse. workplace. Regular cleaning hands before breaks and tection, remove and wash all

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical state	Liquid->Liquid Clear, colorless	Odor	Odorless
Color	No information available	Odor Threshold	No information available
Property	Values	Remarks Method	
рН	<=2	None known	
Melting / freezing point	no data available	None known	
Boiling point / boiling range	no data available	None known	
Flash Point	no data available	None known	
Evaporation Rate	no data available	None known	
Flammability (solid, gas)	no data available	None known	
Flammability Limit in Air		None known	
Upper flammability limit	no data available		
Lower flammability limit	no data available		
Vapor pressure	no data available	None known	
Vapor density	no data available	None known	
Specific Gravity	1	None known	
Water Solubility	Soluble in water	None known	
Solubility in other solvents	no data available	None known	
Partition coefficient: n-octanol/wat	er no data available	None known	
Autoignition temperature	no data available	None known	
Decomposition temperature	no data available	None known	
Kinematic viscosity	no data available	None known	
Dynamic viscosity	no data available	None known	

Explosive properties Oxidizing properties

no data available no data available

Other Information

Softening Point Particle Size Particle Size Distribution no data available no data available

10. STABILITY AND REACTIVITY

Reactivity

no data available.

<u>Chemical stability</u>
 Stable under recommended storage conditions.
 <u>Possibility of Hazardous Reactions</u>
 None under normal processing.
 <u>Hazardous Polymerization</u>
 Hazardous polymerization does not occur.
 <u>Conditions to avoid</u>
 Exposure to air or moisture over prolonged periods.
 <u>Incompatible materials</u>
 Acids. Bases. Oxidizing agent.
 <u>Hazardous Decomposition Products</u>
 Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information	
Inhalation	Specific test data for the substance or mixture is not available. Corrosive by inhalation. (based on components). Inhalation of corrosive fumes/gases may cause coughing, choking, headache, dizziness, and weakness for several hours. Pulmonary edema may occur with tightness in the chest, shortness of breath, bluish skin, decreased blood pressure, and increased heart rate. Inhaled corrosive substances can lead to a toxic edema of the lungs. Pulmonary edema can be fatal. May cause irritation of respiratory tract.
Eye contact	Specific test data for the substance or mixture is not available. Causes burns. (based on components). Corrosive to the eyes and may cause severe damage including blindness. Causes serious eye damage. May cause irreversible damage to eyes.
Skin contact	Specific test data for the substance or mixture is not available. May cause irritation. Prolonged contact may cause redness and irritation.
Ingestion	Specific test data for the substance or mixture is not available. Causes burns. (based on components). Ingestion causes burns of the upper digestive and respiratory tracts. May cause severe burning pain in the mouth and stomach with vomiting and diarrhea of dark blood. Blood pressure may decrease. Brownish or yellowish stains may be seen around the mouth. Swelling of the throat may cause shortness of breath and choking. May cause lung damage if swallowed. May be fatal if swallowed and enters airways. Ingestion may cause irritation to mucous membranes. Ingestion may cause gastrointestinal irritation, nausea, vomiting and diarrhea.

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Hydrochloric Acid 7647-01-0	238 - 277 mg/kg (Rat)	> 5010 mg/kg (Rabbit)	= 1.68 mg/L (Rat)1 h

Information on toxicological effects

Symptoms

Erythema (skin redness). Burning. May cause blindness. Coughing and/ or wheezing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization	No informatio	n available.		
Carcinogenicity	The table bel	ow indicates whether each	agency has listed any ing	redient as a carcinogen.
Chemical Name	ACGIH	IARC	NTP	OSHA
Hydrochloric Acid		Group 1		Х
7647-01-0		Group 3		

Reproductive toxicity	No information available.
STOT - single exposure	No information available.
STOT - repeated exposure	No information available.
Chronic toxicity	No known effect based on information supplied. Chronic exposure to corrosive fumes/gases may cause erosion of the teeth followed by jaw necrosis. Bronchial irritation with chronic cough and frequent attacks of pneumonia are common. Gastrointestinal disturbances may also be seen.
Target Organ Effects	Respiratory system. Eyes. Skin. Gastrointestinal tract (GI).
Aspiration Hazard	No information available.

Numerical measures of toxicity Product Information

The following values are calculated based on chapter 3.1 of the GHS document Not applicable

12. ECOLOGICAL INFORMATION

Ecotoxicity

Harmful to aquatic life.				
Chemical Name	Toxicity to Algae	Toxicity to Fish	Toxicity to Microorganisms	Daphnia Magna (Water Flea)
Hydrochloric Acid 7647-01-0		96h LC50: = 282 mg/L (Gambusia affinis)		

Persistence and Degradability

No information available. Bioaccumulation No information available

Other adverse effects

No information available.

13. DISPOSAL CONSIDERATIONS

Waste treatment methods

Disposal methods	This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261).
Contaminated Packaging	Dispose of contents/containers in accordance with local regulations.
US EPA Waste Number	D002

California Hazardous Waste Codes 791

14. TRANSPORT INFORMATION

DOT Proper Shipping Name Hazard Class	Not regulated NON REGULATED N/A
TDG	Not regulated
<u>MEX</u>	Not regulated

	Not regulated
IATA	Not regulated
Proper Shipping Name	NON REGULATED
Special Provisions	None
IMDG	Not regulated
Special Provisions	None
Marine Pollutant	Not applicable
<u>RID</u>	Not regulated
Special Provisions	None
ADR	Not regulated
Special Provisions	None
ADN	Not regulated

15. REGULATORY INFORMATION

International Inventories	
TSCA	Complies
DSL	All components are listed either on the DSL or NDSL.
ENCS	Contact supplier for inventory compliance status
KECL	Contact supplier for inventory compliance status
PICCS	Contact supplier for inventory compliance status
AICS	Contact supplier for inventory compliance status

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory

DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

EINECS/ELINCS - European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances

ENCS - Japan Existing and New Chemical Substances

IECSC - China Inventory of Existing Chemical Substances

KECL - Korean Existing and Evaluated Chemical Substances

PICCS - Philippines Inventory of Chemicals and Chemical Substances

AICS - Australian Inventory of Chemical Substances

US Federal Regulations

SARA 313

Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical or chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

Chemical Name	CAS-No	Percent	SARA 313 - Threshold Values %
Hydrochloric Acid - 7647-01-0	7647-01-0	0.09	1.0
SARA 311/312 Hazard Categories			
Acute Health Hazard	Yes		
Chronic Health Hazard	No		
Fire Hazard	No		
Sudden release of pressure hazard	No		
Reactive Hazard	No		
CWA (Clean Water Act)			

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

Chemical Name	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants	CWA - Hazardous Substances
Hydrochloric Acid 7647-01-0	5000 lb			Х

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level

pertaining to releases of this material

Chemical Name	Hazardous Substances RQs	Extremely Hazardous Substances RQs	RQ
Hydrochloric Acid 7647-01-0	5000 lb	5000 lb	RQ 5000 lb final RQ RQ 2270 kg final RQ

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

International Regulations

Component	Carcinogen Status	Exposure Limits
Hydrochloric Acid		Mexico: Ceiling 5 ppm
7647-01-0 (0.09)		Mexico: Ceiling 7 mg/m ³

Canada

WHMIS Hazard Class

INOT	aeterminea	

16. OTHER INFORMATION					
NFPA	Health Hazards 3	Flammability 0	Instability 0	Physical and Chemical Hazards	
HMIS	Health Hazards 3	Flammability 0	Physical Hazard 0	Personal Protection	
Prepared By	Product Stewardship 23 British American Blvd. Latham, NY 12110 1-800-572-6501				
Issuing Date	03-Nov-2015				
Revision Date	21-Jul-20	015			
Revision Note	No information available				

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text



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End of Safety Data Sheet

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.5 Revision Date 08/14/2014 Print Date 04/13/2016

1.1	Product identifiers Product name	:	trans-Chlordane
	Product Number Brand	:	PS752 Supelco
	CAS-No.	:	5103-74-2
1.2 Relevant identified uses of the substance		e substance or mixture and uses advised against	
	Identified uses	:	Laboratory chemicals, Manufacture of substances
1.3	I.3 Details of the supplier of the safety data sheet		safety data sheet
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Carcinogenicity (Category 2), H351 Acute aquatic toxicity (Category 1), H400 Chronic aquatic toxicity (Category 1), H410

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word	Warning
Hazard statement(s)	
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H410	Very toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P281	Use personal protective equipment as required.

IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell.
IF exposed or concerned: Get medical advice/ attention.
Rinse mouth.
Collect spillage.
Store locked up.
Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Molecular weight	:	409.76 g/mol
CAS-No.	:	5103-74-2
EC-No.	:	225-826-0

Hazardous components

Component	Classification	Concentration
trans-Chlordane		
	Acute Tox. 4; Carc. 2; Aquatic Acute 1; Aquatic Chronic 1;	90 - 100 %
	H302, H351, H410	

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Safety glasses with side-shields conforming to EN166 Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: crystalline Colour: white	
b)	Odour	odourless	
c)	Odour Threshold	No data available	
d)	рН	No data available	
e)	Melting point/freezing point	No data available	
f)	Initial boiling point and boiling range	No data available	
g)	Flash point	No data available	
h)	Evaporation rate	No data available	
i)	Flammability (solid, gas)	No data available	
j)	Upper/lower flammability or explosive limits	No data available	
k)	Vapour pressure	No data available	
I)	Vapour density	No data available	
m)	Relative density	1.590 g/cm3	
n)	Water solubility	insoluble	
o)	Partition coefficient: n- octanol/water	No data available	
p)	Auto-ignition temperature	No data available	
q)	Decomposition temperature	No data available	
r)	Viscosity	No data available	
s)	Explosive properties	No data available	
t)	Oxidizing properties	No data available	
Other safety information No data available			

10. STABILITY AND REACTIVITY

10.1 Reactivity No data available

9.2

- **10.2 Chemical stability** Stable under recommended storage conditions.
- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents
- **10.6 Hazardous decomposition products** Other decomposition products - No data available

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Mouse - 275 mg/kg

LD50 Oral - Rat - 1,100 mg/kg

Inhalation: No data available

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity No data available

No data available

Carcinogenicity

Limited evidence of carcinogenicity in animal studies

IARC: 2B - Group 2B: Possibly carcinogenic to humans (trans-Chlordane)

- ACGIH: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by ACGIH.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information RTECS: Not available

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish

LC50 - Lepomis macrochirus - 0.05 mg/l - 96 h

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal. Very toxic to aquatic life.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (trans-Chlordane) Reportable Quantity (RQ): Marine pollutant: No Poison Inhalation Hazard: No

IMDG

UN number: 3077 Class: 9 Packing group: III EMS-No: F-A, S-F Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S. (trans-Chlordane) Marine pollutant: Marine pollutant

ΙΑΤΑ

UN number: 3077 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, solid, n.o.s. (trans-Chlordane)

15. REGULATORY INFORMATION

SARA 302 Components

No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know ComponentsCAS-No.trans-Chlordane5103-74-2

AS-No. Revision D)ate
03-74-2	
4	AS-No. Revision D 03-74-2

California Prop. 65 Components

Revision Date

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox.	Acute toxicity
Aquatic Acute	Acute aquatic toxicity
Aquatic Chronic	Chronic aquatic toxicity
Carc.	Carcinogenicity
H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H400	Very toxic to aquatic life.
H410	Very toxic to aquatic life with long lasting effects.

HMIS Rating

Health hazard:	1	
Chronic Health Hazard:	*	
Flammability:	0	
Physical Hazard	0	
NFPA Rating		
NFPA Rating Health hazard:	2	
NFPA Rating Health hazard: Fire Hazard:	2 0	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.5

Revision Date: 08/14/2014

Print Date: 04/13/2016

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SAFETY DATA SHEET

Version 4.17 Revision Date 03/03/2015 Print Date 02/19/2016

1. PR	1. PRODUCT AND COMPANY IDENTIFICATION					
1.1	Product identifiers Product name	:	Trichlorofluoromethane			
	Product Number Brand	:	254991 Aldrich			
	CAS-No.	:	75-69-4			
1.2	Relevant identified uses of the substance or mixture and uses advised against					
	Identified uses	:	Laboratory chemicals, Manufacture of substances			
1.3 Details of the supplier of the safety data sheet		safety data sheet				
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA			
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052			
1.4	Emergency telephone n	umbe	r			
	Emergency Phone #	:	(314) 776-6555			

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Dermal (Category 4), H312

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

<	!	>
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Signal word	Warning
Hazard statement(s) H312	Harmful in contact with skin.
Precautionary statement(s)	Wear protective gloves/ protective clothing.
P280	IF ON SKIN: Wash with plenty of soap and water. Call a POISON
P302 + P352 + P312	CENTER or doctor/ physician if you feel upwell
P363	Wash contaminated clothing before reuse.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

- Synonyms
- : Fluorotrichloromethane CFC-11

:	CCI3F CCI3F
:	137.37 g/mol
:	75-69-4
:	200-892-3
	:

Hazardous components

Component	Classification	Concentration	
Trichlorofluoromethane			
	Acute Tox. 4; H312	<= 100 %	
For the full text of the H-Statements mentioned in this Section, see Section 16.			

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

- **5.2** Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas, Hydrogen fluoride
- **5.3** Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.
- 5.4 Further information No data available

6. ACCIDENTAL RELEASE MEASURES

- 6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. For personal protection see section 8.
- 6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up Soak up with inert absorbent material and dispose of as hazardous waste. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid inhalation of vapour or mist. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place.

Recommended storage temperature 2 - 8 °C

Contents under pressure. Storage class (TRGS 510): Non Combustible Liquids

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Trichlorofluorometha ne	75-69-4	С	1,000.000000 ppm	USA. ACGIH Threshold Limit Values (TLV)
	Remarks	Cardiac sens	sitization ole as a human cai	rcinogen
		С	1,000.000000 ppm 5,600.000000 mg/m3	USA. NIOSH Recommended Exposure Limits
		TWA	1,000.000000 ppm 5,600.000000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		The value in	mg/m3 is approxin	nate.

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.4 mm Break through time: 480 min Material tested:Camatril® (KCL 730 / Aldrich Z677442, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.2 mm Break through time: 30 min Material tested:Dermatril® P (KCL 743 / Aldrich Z677388, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: liquid, clear Colour: colourless
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	-110.99109.99 °C (-167.78165.98 °F)
f)	Initial boiling point and boiling range	23.7 °C (74.7 °F) - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapour pressure	885.7 hPa (664.3 mmHg) at 20.0 °C (68.0 °F) 2,701.2 hPa (2,026.1 mmHg) at 55.0 °C (131.0 °F)
I)	Vapour density	No data available
m)	Relative density	1.494 g/cm3 at 25 °C (77 °F)
n)	Water solubility	1 g/l
o)	Partition coefficient: n- octanol/water	log Pow: 2.53
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available

- t) Oxidizing properties
 - No data available
- 9.2 Other safety information
 - Surface tension

18.0 mN/m at 25.0 °C (77.0 °F)

10. STABILITY AND REACTIVITY

10.1 Reactivity

No data available

10.2 Chemical stability Stable under recommended storage conditions.

- **10.3 Possibility of hazardous reactions** No data available
- **10.4 Conditions to avoid** No data available
- **10.5** Incompatible materials Strong oxidizing agents, Sodium/sodium oxides, Potassium, Magnesium, Aluminum, Zinc

10.6 Hazardous decomposition products Other decomposition products - No data available

In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

LD50 Oral - Rat - > 15,000 mg/kg

LC50 Inhalation - Rat - 0.3 h - 130000 ppm Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Respiratory disorder

No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

No data available

Carcinogenicity

- IARC: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

No data available

No data available

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

ich - 254004

Aspiration hazard

No data available

Additional Information

RTECS: PB6125000

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated., Nausea, Dizziness, Headache, Vomiting, Diarrhoea, Abdominal pain, Weakness, Unconsciousness

Liver -

12. ECOLOGICAL INFORMATION

12.1 Toxicity

No data available

- **12.2 Persistence and degradability** No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available
- 12.5 Results of PBT and vPvB assessment PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 3082 Class: 9 Packing group: III Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Trichlorofluoromethane) Reportable Quantity (RQ): 5000 lbs

Poison Inhalation Hazard: No

IMDG

Not dangerous goods

IATA Not dangerous goods

15. REGULATORY INFORMATION

SARA 302 Components No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components

The following components are subject to reporting level	s established by SARA Title	III, Section 313:
	CAS-No.	Revision Date

75-69-4

2007-07-01

Trichlorofluoromethane

SARA 311/312 Hazards Acute Health Hazard

Massachusetts Right To Know Components

	CAS-No.	Revision Date
Trichlorofluoromethane	75-69-4	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Trichlorofluoromethane	75-69-4	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Trichlorofluoromethane	75-69-4	2007-07-01

California Prop. 65 Components

This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute Tox. H312	Acute toxicity Harmful in contact with skin.
HMIS Rating Health hazard: Chronic Health Haz Flammability: Physical Hazard	1 ard: 0 0
NFPA Rating Health hazard: Fire Hazard: Reactivity Hazard:	1 0 0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 4.17

Revision Date: 03/03/2015

Print Date: 02/19/2016



MATERIAL SAFETY DATA SHEET SIFCO Process Trivalent Chromium Conversion

	HEALTH * FLAMMABILITY PHYSICAL HAZ PPE	3 0 Health	ility Instability 3 0 Special	Printed: 12/03/2010 Revision: 12/03/2010 Supercedes Revision: 11/02/2010 Date Created: 07/13/2009	
1. F	Product and	Company l	dentificatio	n	
Product Code:	3007				
Product Name:	SIFCO Proces	s Trivalent Chro	mium Conversio	n	
Manufacturer Information					
Company Name:	SIFCO Applie Division of SIF 5708 E. Schaa Independence	d Surface Conce CO Industries, I af Road , OH 44131	epts nc.		
Phone Number:	(216)524-0099	Э			
Fax Number:	(216)524-633	1			
Emergency Contact:	CHEMTREC (United States)	(800)42	4-9300	
Information:	CHEMTREC (International-Co	ollect) +1 (7	03)527-3887	
Web site address:	http://www.SIF	COASC.com			
Email address:	info@sifcoasc	.com			
	2. Hazar	ds Identific	ation		
Emergency Overview					
Caution! May cause eye and Contains materials that can ca	skin burns. May be	harmful if swal	lowed.	r.	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may of INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be cor CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause es. May cause burn prrosive to the skin. ins material that ma e y. See section abo	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details.	Eyes? Yes to the respirator throat and stom ns. rgan damage.	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach.	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. Co	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause es. May cause burn prosive to the skin. ins material that ma re y. See section above mposition/In	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details.	Eyes? Yes Eyes? Yes to the respirator throat and stom ns. rgan damage.	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach.	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entr 3. CO Hazardous Components (Chemical Name)	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause burnor orrosive to the skin. ins material that ma re y. See section above mposition/In CAS #	that is irritating that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation Concentration	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredic Formula	Ingestion? Yes y system. Exposure to ach.	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may of INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. CO Hazardous Components (Chemical Name) 1. Sodium nitrate	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause es. May cause burn prosive to the skin. ins material that ma re y. See section abov mposition/In CAS # 7631-99-4	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation 1.0 -3.0 %	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula	ents RTECS # WC5600000	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. CO Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(St	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause by cause burn prosive to the skin. ins material that ma re y. See section above mposition/In CAS # 7631-99-4 D(4)) 12336-95-7 10026 24.4	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation 1.0 -3.0 % 1.0 -3.0 %	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula NaNO3 CrHO5S	ents RTECS # WC5600000 GB6240000 CC22200000	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entr 3. Co Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(Si 3. Cobalt sulfate heptahydrate 4. Ammonium bifuoride	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause burnor osive to the skin. ins material that ma e y. See section above mposition/In CAS # 7631-99-4 O4)) 12336-95-7 10026-24-1 1341-49-7	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation 1.0 -3.0 % 1.0 -3.0 % 0.3 -1.0 %	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula NaNO3 CrHO5S CoSO4.7H2O F2H5N	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach. ents RTECS # WC5600000 GB6240000 GG3200000 BO9200000	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. CO Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(S) 3. Cobalt sulfate heptahydrate 4. Ammonium bifluoride 5. Water	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause burnor dust material that material that material ins material that material y. See section above mposition/In CAS # 7631-99-4 O4)) 12336-95-7 10026-24-1 1341-49-7 7732-18-5	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation 1.0 -3.0 % 1.0 -3.0 % 0.3 -1.0 % 92.0 -97.4 %	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula NaNO3 CrHO5S CoSO4.7H2O F2H5N H2O	ents RTECS # WC5600000 GG3200000 BQ9200000 ZC0110000	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may of INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be cor CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. Coo Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(S) 3. Cobalt sulfate heptahydrate 4. Ammonium bifluoride 5. Water	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause es. May cause burn prosive to the skin. ins material that ma re y. See section abov mposition/In CAS # 7631-99-4 O4)) 12336-95-7 10026-24-1 1341-49-7 7732-18-5 4 Eirst	that is irritating rd. burns to mouth, s. May cause burn ay cause target o ve for details. formation 1.0 -3.0 % 1.0 -3.0 % 0.3 -1.0 % 92.0 -97.4 % Aid Measu	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula NaNO3 CrHO5S CoSO4.7H2O F2H5N H2O	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach. ents RTECS # WC5600000 GB6240000 GG3200000 BQ9200000 ZC0110000	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be co CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entr 3. CO Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(Si 3. Cobalt sulfate heptahydrate 4. Ammonium bifluoride 5. Water	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause by cause burn prosive to the skin. ins material that ma re y. See section abov mposition/In CAS # 7631-99-4 04)) 12336-95-7 10026-24-1 1341-49-7 7732-18-5 4. First	that is irritating rd. burns to mouth, s. May cause burn ay cause target of ve for details. formation 1.0 -3.0 % 1.0 -3.0 % 0.3 -1.0 % 0.3 -1.0 % 92.0 -97.4 % Aid Measu	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. On Ingredie Formula NaNO3 CrHO5S CoSO4.7H2O F2H5N H2O	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach. Physical Action of the system	
Response Guide #171 Route(s) of Entry: Health Hazards (Acute and Chror INHALATION: May give off decomposition products may of INGESTION: Harmful if swa EYE: May be corrosive to eye SKIN CONTACT: May be cor CHRONIC EFFECTS: Conta Signs and Symptoms Of Exposur Dependant on route(s) of entry 3. COC Hazardous Components (Chemical Name) 1. Sodium nitrate 2. Chromium hydroxide sulphate (Cr(OH)(S) 3. Cobalt sulfate heptahydrate 4. Ammonium bifluoride 5. Water Emergency and First Aid Proceed First aid providers must take	Inhalation? Ye ic) gas, vapor or dust cause a health haza llowed. May cause es. May cause burn prosive to the skin. ins material that ma e y. See section abov mposition/In CAS # 7631-99-4 O4)) 12336-95-7 10026-24-1 1341-49-7 7732-18-5 4. First proper precautions	that is irritating rd. burns to mouth, s. May cause burn ay cause target of ve for details. formation 1.0 -3.0 % 1.0 -3.0 % 0.3 -1.0 % 92.0 -97.4 % Aid Measu	materials which Eyes? Yes to the respirator throat and stom ns. rgan damage. on Ingredie Formula NaNO3 CrHO5S CoSO4.7H2O F2H5N H2O Ires	can cause cancer. Emergency Ingestion? Yes y system. Exposure to ach. ents RTECS # WC5600000 GB6240000 GG3200000 BQ9200000 ZC0110000	

immediately call the Emergency Medical Service, 911-Operator, Hospital, Physician, Ophthalmologist or Poison Control Center, as applicable. Give the following information: Location of the accident, your phone number, description of the accident, name of chemical agent and product, number and condition of casualties, what is



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being done for the victims.

Stay on the phone until the other party hangs up! Remove victim from contaminated area to a clean, quiet, ventilated area. Keep them calm and warm.

EYES: Hold eyelids apart and flush eyes with plenty of water for at least 15 minutes.

SKIN: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Thoroughly decontaminate (or discard) clothing and shoes.

INHALATION: Remove to fresh air. Lay victim down, legs raised. Loosen tight clothing, cover with a blanket. If not breathing, give artificial respiration.

INGESTION: DO NOT induce vomiting, unless advised by EMS. Give large quantities of water. Never give anything by mouth to an unconscious person.

	5.	Fire Fig	hting	Measures	
--	----	-----------------	-------	----------	--

Flammability Classification: Material will not burn

Flash Pt:

Explosive Limits: LEL: UEL:

Special Fire Fighting Procedures

Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Unusual Fire and Explosion Hazards

Suitable Extinguishing Media

Use an extinguishing agent suitable for the surrounding fire.

Unsuitable Extinguishing Media

None known.

6. Accidental Release Measures

Steps To Be Taken In Case Material Is Released Or Spilled

Do not touch or walk through spilled material. Isolate hazard area and keep people away. Notify your facility emergency coordinator. Eliminate all sources of ignition. Provide maximum ventilation. Do not release into soil, sewers, or natural bodies of water. Wear proper personal protective equipment (PPE). Carefully mop up or vacuum spill and triple rinse with water into suitable plastic container. Release of a reportable quantity (RQ) requires notification of proper authorities. Dispose of according to local, state, and federal regulations.

7. Handling and Storage

Precautions To Be Taken in Handling

Put on appropriate personal protective equipment. Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking.

Do not get in eyes or on skin or clothing. Do not breathe vapor or mist. Do not ingest. If during normal use the material presents a respiratory hazard, use only with adequate ventilation or wear appropriate respirator. Keep in the original container or an approved alternative made from a compatible material, kept tightly closed when not in use. Empty containers retain product residue and can be hazardous. Do not reuse container.

Precautions To Be Taken in Storing

Store in accordance with local regulations. Store in original container protected from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials. Keep container tightly closed and sealed until ready for use. Containers that have been opened must be carefully resealed and kept upright to prevent leakage. Do not store in unlabeled containers. Use appropriate containment to avoid environmental contamination.



MATERIAL SAFETY DATA SHEET SIFCO Process Trivalent Chromium Conversion

	8. Exposure Controls/Personal Protection				
На	zardous Components (Chemical Name)	CAS #	OSHA PEL	ACGIH TLV	Other Limits
1.	Sodium nitrate	7631-99-4		10 mg/m3	
2.	Chromium hydroxide sulphate (Cr(OH)(SO4))	12336-95-7			
3.	Cobalt sulfate heptahydrate	10026-24-1			
4.	Ammonium bifluoride	1341-49-7			
5.	Water	7732-18-5			

Respiratory Equipment (Specify Type)

If engineering controls are not feasible, the respiratory protection program must comply with OSHA 29 CFR 1910.134

Eye Protection

Face shield and safety glasses w/side shields or splash-proof chemical goggles. Do not wear contact lenses. Eye wash station, safety shower, washing facilities near work area.

Protective Gloves

Nitrile gloves.

Ventilation

If user operations generate dust, fumes, gas, vapor or mist, use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits.

Work/Hygienic/Maintenance Practices

Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

9. Physical and Chemical Properties				
Physical States:	[]Gas [X]Liquid []Solid			
Explosive Limits:	LEL: UEL:			
Specific Gravity (Water = 1):	1.045 - 1.050			
Density:	1.03 - 1.07			
pH:	2.0 - 2.5			
Appearance and Odor				
Blue liquid with no characteristic odor.				
	10. Stability and Reactivity			
Stability:	Unstable [] Stable [X]			
Conditions To Avoid - Instability				
Incompatibility - Materials To Avoid				
Hazardous Decomposition Or Byproducts				
Possibility of Hazardous Reactions: Will occur [] Will not occur [X]				
Conditions To Avoid - Hazardous Reactions				
Avoid exposure - obtain special instructions before use.				
	11. Toxicological Information			
Inhalation : May give off gas, v	apor or dust that is irritating or corrosive to the respiratory			
system Exposure to decomposi	tion products may cause a health hazard			

system. Exposure to decomposition products may cause a health hazard.

Ingestion : Harmful if swallowed. May cause burns to mouth, throat and stomach.

Skin : May be corrosive to the skin. May cause burns.

Eyes : May be corrosive to eyes. May cause burns.


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Carcinogenicity/Other Information

Hazardous Components (Chemical Name)		CAS #	NTP	IARC	ACG	SIH OSHA
1.	Sodium nitrate	7631-99-4				
2.	Chromium hydroxide sulphate (Cr(OH)(SO4))	12336-95-7				
3.	Cobalt sulfate heptahydrate	10026-24-1		2B	A3	
4.	Ammonium bifluoride	1341-49-7				
5.	Water	7732-18-5				
Carcinogenicity:		NTP? Unknow	n l	ARC Monographs? Unk	nown	OSHA Regulated?
		Unknown		U .		Ũ

12. Ecological Information

No known significant effects or critical hazards.

13. Disposal Considerations

Waste Disposal Method

Ship to approved treatment/disposal facility. Dispose of according to local, state, and federal regulations. Follow the applicable regulations for disposal of empty containers and rinsate. The disposal information applies to the material as manufactured. Contamination may affect the disposal requirements. The responsibility for proper waste disposal is with the generator of the waste.

14. Transport Information

LAND TRANSPORT (US DOT)	
DOT Proper Shipping Name	UN3082, Environmentally hazardous substances, liquid, n.o.s.
	(Chromium Sulphate) PG III - ERG 171
DOT Hazard Class:	9
DOT Hazard Label:	CLASS 9
UN/NA Number:	UN3082
Packing Group:	III
LAND TRANSPORT (Canadian TDG)	
UN Number:	3082
Packing Group:	III
LAND TRANSPORT (European ADR	/RID)
UN Number:	3082
Packing Group:	III
AIR TRANSPORT (ICAO/IATA)	
UN Number:	3082
Packing Group:	III
IATA Classification:	9
MARINE TRANSPORT (IMDG/IMO)	
UN Number:	3082
Packing Group:	III
Marine Pollutant:	No

15. Regulatory Information

На	zardous Components (Chemical Name)	CAS #	Sec.302 (EHS)	Sec.304 RQ	Sec.313 (TRI)	Sec.110
1.	Sodium nitrate	7631-99-4	No	No	Yes-Cat. N511	No
2.	Chromium hydroxide sulphate (Cr(OH)(SO4))	12336-95-7	No	No	Yes-Cat. N090	No
3.	Cobalt sulfate heptahydrate	10026-24-1	No	No	No	No
4.	Ammonium bifluoride	1341-49-7	No	Yes 100 LB	No	No

US EPA SARA Title III



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					•				
Ha	zardous Components (Chemical Name)	CAS #	Sec.302 (EHS)	Sec.304 RQ	Sec.313 (TRI)	Sec.110			
5.	Water	7732-18-5	No	No	No	No			
U	S EPA CAA, CWA, TSCA								
Ha	zardous Components (Chemical Name)	CAS #	EPA CAA	EPA CWA NPDES	EPA TSCA	CA PROP 65			
1.	Sodium nitrate	7631-99-4	HAP, ODC ()	No	Inventory, 8A CAIR	No			
2.	Chromium hydroxide sulphate (Cr(OH)(SO4))	12336-95-7	HAP, ODC ()	No	Inventory	No			
3.	Cobalt sulfate heptahydrate	10026-24-1	HAP, ODC ()	No	No	Yes			
4. r	Ammonium bifluoride	1341-49-7	HAP, ODC ()	No	Inventory	No			
5.	vvater	7732-18-5	HAP, ODC ()	NO	Inventory	NO			
3/	ARA (Superrund Amendments and								
R	Eauthorization Act of 1986) Lists:		ша (: 202 Б		· 1 ·(1 TDO * ·	1. 10000			
	Sec.302:	LPA SARA Title	III Section 302 Ex	tremely Hazardous Ch	emical with TPQ. * 1	ndicates 10000			
	Soc 204:	EDA SADA Titla	III Section 204: Cl	EDCI A Deportable - 9	an 202 with Deportab	la Quantity **			
	Jec. J04.	indicates statutor	III Section 504. CI	EKCLA Reportable + 3	sec.302 with Reportab	le Quantity.			
	Sec 313	EPA SARA Title	III Section 313 To	vic Release Inventory	Note: -Cat indicates a	member of a			
		chemical category		xie Release inventory.	NoteCat indicates a	member of a			
	Sec.110:	EPA SARA 110 Superfund Site Priority Contaminant List							
т	SCA (Toxic Substances Control	Liffordititio	Superiana Site I no	ing containinant Eist					
Δ	ct) Lists								
	Inventory:	Chemical Listed in the TSCA Inventory.							
	5A(2):	Chemical Subject to Significant New Rules (SNURS)							
	6A:	Commercial Chemical Control Rules							
	8A:	Toxic Substances Subject To Information Pules on Production							
	8A CAIR:	Comprehensive A	Assessment Informa	tion Rules - (CAIR)					
	8A PAIR:	Preliminary Asse	ssment Information	Rules - (PAIR)					
	8C:	Records of Allega	ations of Significan	t Adverse Reactions					
	8D:	Health and Safety	/ Data Reporting R	ules					
	8D TERM:	Health and Safety	Data Reporting R	ule Terminations					
	12(b):	Notice of Export							
0	ther Important Lists:	riouee of Enpore							
Ŭ	CWA NPDES:	EPA Clean Water	r Act NPDES Perm	it Chemical					
	CAA HAP:	EPA Clean Air A	ct Hazardous Air P	Collutant					
	CAA ODC:	EPA Clean Air A	ct Ozone Depleting	Chemical (1=CEC 2=	HCFC)				
	CA PROP 65:	California Propos	sition 65						
In	ternational Regulatory Lists:	Cumornia Propos							
FI	PA Hazard Categories:								
	This material meets the EDA 'Hay	zard Catagorias	defined for SA	PA Title III Sectio	$n_{\rm S} 311/312$ as ind	icated.			
	This material meets the EFA Ha			diata) Haalth Haza	ns 511/512 as mu	icateu.			
					ิเน				
			Gine Line and	iyed) Health Hazar	u				
			Fire Hazard	(D)))					
		[] Yes [X] No	Sudden Rele	ase of Pressure Ha	azard				

[] Yes [X] No Reactive Hazard

Regulatory Information

U.S. FEDERAL REGULATIONS:

1. Supplier Notification about toxic Chemicals.

SIFCO Applied Surface Concepts is required to inform you, that this product contains a toxic chemical or chemicals subject to the reporting requirements of Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372, if specified annual thresholds are met or exceeded.

Toxic ChemicalCAS #Wt.% (Maximum)Chromium Sulphate-12336-95-7-3%



Your other suppliers of trade name products or mixtures containing section 313 chemicals must also notify you. If you repackage or otherwise redistribute this product to industrial customers you are required to furnish similar notification to them.

2. CERCLA and EPCRA:Threshold Planning Quantity:N/A(Release) Reportable Quantity:N/AExtremely Hazardous Substance:None

3. EPCRA Hazard Categories:Immediate (Acute) Health:YesDelayed (Chronic) Health:YesFire:NoSudden release of Pressure:NoReactivity:No

4. TSCA Statement.

All ingredients of this product are listed under the Toxic Substances Control Act (TSCA).

5. ODS Certification. This product does not contain and is not manufactured with Ozone Depleting Substances (ODS).

6. VOC Certification. This product does not contain any Volatile Organic Compounds (VOC).

7. PCB Certification. This product does not contain any polychlorinated biphenyls (PCB).

STATE REGULATIONS: California Prop. 65: WARNING! This product contains chemicals known to the state of California to cause cancer, birth defects, or other reproductive harm.

INTERNATIONAL REGULATIONS: WHMIS Classification. Class D-2B

16. Other Information

Company Policy or Disclaimer

DISCLAIMER:

This information is believed to be accurate and represents the best information currently available to us. However, we make no warrenty of merchantability or any other warranty, express or implied, with respect to such information, and we assume no liability resulting from its use. Users should make their own investigations to determine the suitability of the information for their particular purposes.

SIGMA-ALDRICH

sigma-aldrich.com

SAFETY DATA SHEET

Version 5.8 Revision Date 03/13/2015 Print Date 01/29/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	:	Vanadium(V) oxide				
	Product Number Brand Index-No.	:	204854 Aldrich 023-001-00-8				
	CAS-No.	:	1314-62-1				
1.2	Relevant identified uses of the substance or mixture and uses advised against						
	Identified uses	:	Laboratory chemicals, Manufacture of substances				
1.3	Details of the supplier of the safety data sheet						
	Company	:	Sigma-Aldrich 3050 Spruce Street SAINT LOUIS MO 63103 USA				
	Telephone Fax	:	+1 800-325-5832 +1 800-325-5052				
1.4	Emergency telephone num	ıbe	r				

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302 Acute toxicity, Inhalation (Category 4), H332 Serious eye damage (Category 1), H318 Germ cell mutagenicity (Category 2), H341 Reproductive toxicity (Category 2), H361 Specific target organ toxicity - single exposure (Category 3), Respiratory system, H335 Specific target organ toxicity - repeated exposure (Category 1), H372 Acute aquatic toxicity (Category 2), H401 Chronic aquatic toxicity (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram



Signal word

Danger	
Danger	

Hazard statement(s)	
H302 + H332	Harmful if swallowed or if inhaled
H318	Causes serious eye damage.
H335	May cause respiratory irritation.
H341	Suspected of causing genetic defects.
H361	Suspected of damaging fertility or the unborn child.
H372	Causes damage to organs through prolonged or repeated exposure.
004054	

H411	Toxic to aquatic life with long lasting effects.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapours/ spray.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER or doctor/ physician if you feel unwell. Rinse mouth.
P304 + P340 + P312	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a POISON CENTER or doctor/ physician if you feel unwell.
P305 + P351 + P338 + P310	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Immediately call a POISON CENTER or doctor/ physician.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P403 + P233 P405	Store in a well-ventilated place. Keep container tightly closed. Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances

Formula	:	0 ₅ V ₂
Molecular weight	:	181.88 g/mol
CAS-No.	:	1314-62-1
EC-No.	:	215-239-8
Index-No.	:	023-001-00-8

Hazardous components

Component	Classification	Concentration				
Vanadium pentoxide						
	Acute Tox. 4; Eye Dam. 1; Muta. 2; Repr. 2; STOT SE 3; STOT RE 1; Aquatic Acute 2; Aquatic Chronic 2; H302 + H332, H318, H335, H341, H361, H372, H411	<= 100 %				
		1				

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 Description of first aid measures

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes and consult a physician.

If swallowed

Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

- **4.2** Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11
- **4.3 Indication of any immediate medical attention and special treatment needed** No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

- 5.2 Special hazards arising from the substance or mixture Vanadium/vanadium oxides
- **5.3** Advice for firefighters Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

No data available

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures Use personal protective equipment. Avoid dust formation. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

For personal protection see section 8.

- 6.2 Environmental precautions Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.
- 6.3 Methods and materials for containment and cleaning up Pick up and arrange disposal without creating dust. Sweep up and shovel. Keep in suitable, closed containers for disposal.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid contact with skin and eyes. Avoid formation of dust and aerosols. Further processing of solid materials may result in the formation of combustible dusts. The potential for combustible dust formation should be taken into consideration before additional processing occurs.

Provide appropriate exhaust ventilation at places where dust is formed. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities Keep container tightly closed in a dry and well-ventilated place. Storage class (TRGS 510): Non-combustible, acute toxic Cat.3 / toxic hazardous materials or hazardous materials causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CAS-No.	Value	Control parameters	Basis
Vanadium pentoxide	1314-62-1	С	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		С	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
	Remarks	Ceiling limit	is to be determined	I from breathing-zone air samples.
		TWA	0.050000 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respi Lower Respi Substances (see BEI® se Confirmed a	ratory Tract irritatic ratory Tract irritatic for which there is a ection) nimal carcinogen v	on on a Biological Exposure Index or Indices vith unknown relevance to humans
		TWA	0.05 mg/m3	USA. ACGIH Threshold Limit Values (TLV)
		Upper Respi Lower Respi Substances (see BEI® so Confirmed a	on on a Biological Exposure Index or Indices vith unknown relevance to humans	
		С	0.050000 mg/m3	USA. NIOSH Recommended
		15 minute ce	eiling value	
		C	0.050000	USA. NIOSH Recommended
		15 minute ce	iling value	
		C	0.100000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Ceiling limit	is to be determined	from breathing-zone air samples.
		С	0.500000 mg/m3	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants
		Ceiling limit	is to be determined	from breathing-zone air samples.
		С	0.050000 mg/m3	USA. NIOSH Recommended Exposure Limits
		15 minute ce	eiling value	
		С	0.050000	USA. NIOSH Recommended
		45	mg/m3	Exposure Limits
		15 minute ce		
		C	0.050000 mg/m3	Exposure Limits
		15 minute ce	eiling value	
		С	0.050000 mg/m3	USA. NIOSH Recommended
		15 minute ce	eiling value	

Biological occupational exposure limits

Component	CAS-No.	Parameters	Value	Biological	Basis	
				specimen		
Vanadium pentoxide	1314-62-1	Vanadium	0.0500	In urine		
			mg/g			
	Remarks	End of shift at end of workweek				

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Full contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

Splash contact Material: Nitrile rubber Minimum layer thickness: 0.11 mm Break through time: 480 min Material tested:Dermatril® (KCL 740 / Aldrich Z677272, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains. Discharge into the environment must be avoided.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

- a) Appearance Form: solid
- b) Odour No data available
 c) Odour Threshold No data available
 d) pH No data available
- e) Melting point/freezing Melting point/range: 690 °C (1,274 °F) lit. point
- f) Initial boiling point and No data available boiling range
- g) Flash point Not applicable

	h)	Evaporation rate	No data available			
	i)	Flammability (solid, gas)	No data available			
	j)	Upper/lower flammability or explosive limits	No data available			
	k)	Vapour pressure	No data available			
	I)	Vapour density	No data available			
	m)	Relative density	3.35 g/mL at 25 °C (77 °F)			
	n)	Water solubility	904 g/l at 20 °C (68 °F) - OECD Test Guideline 105			
	o)	Partition coefficient: n- octanol/water	No data available			
	p)	Auto-ignition temperature	No data available			
	q)	Decomposition temperature	No data available			
	r)	Viscosity	No data available			
	s)	Explosive properties	No data available			
	t)	Oxidizing properties	The substance or mixture is not classified as oxidizing.			
	Oth	ner safety information				
		Solubility in other solvents	Ethanol - insoluble			
ST	AB	LITY AND REACTIVITY				
	_					

10.

10.1 Reactivity No data available

9.2

- 10.2 Chemical stability Stable under recommended storage conditions.
- 10.3 Possibility of hazardous reactions No data available
- 10.4 Conditions to avoid No data available
- 10.5 Incompatible materials Strong acids
- **10.6 Hazardous decomposition products** Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity

Harmful if swallowed. Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

LC50 Inhalation - Rat - female - 4 h - 2.21 mg/l (OECD Test Guideline 403)

LC50 Dermal - Rat - > 2,500 mg/kg (OECD Test Guideline 402)

No data available

Skin corrosion/irritation

Skin - in vitro assay Result: No skin irritation

Serious eye damage/eye irritation

Eyes - Rabbit Result: Risk of serious damage to eyes. (OECD Test Guideline 405)

Respiratory or skin sensitisation No data available

Germ cell mutagenicity

Laboratory experiments have shown mutagenic effects. In vitro tests showed mutagenic effects

Carcinogenicity

No data available

- IARC: 2B Group 2B: Possibly carcinogenic to humans (Vanadium pentoxide)
- NTP: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
- OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Reproductive toxicity

Possible risk of congenital malformation in the fetus. Suspected human reproductive toxicant

No data available

Specific target organ toxicity - single exposure

May cause respiratory irritation. Classified according to Regulation (EU) 1272/2008, Annex VI (Table 3.1/3.2)

Specific target organ toxicity - repeated exposure

Causes damage to organs through prolonged or repeated exposure.

Aspiration hazard

No data available

Additional Information

RTECS: Not available

To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Stomach - Irregularities - Based on Human Evidence Stomach - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity

Toxicity to fish	LC50 - Oncorhynchus mykiss (rainbow trout) - 5.2 mg/l - 96.0 h
Toxicity to daphnia and	LC50 - Daphnia magna (Water flea) - 1.52 mg/l - 48 h

other aquatic invertebrates

12.2 Persistence and degradability No data available

12.3 Bioaccumulative potential

No data available

12.4 Mobility in soil

No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

Toxic to aquatic life with long lasting effects. An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 2862 Proper shipping nam Reportable Quantity	Class: 6.1 ne: Vanadium pentoxide (RQ): 1000 lbs	Packing group: I	II		
Poison Inhalation Ha	azard: No				
IMDG UN number: 2862 Proper shipping nam Marine pollutant:yes IATA	Class: 6.1 ne: VANADIUM PENTOXIDE	Packing group: I	II EMS-No	9: F-A, S-A	
UN number: 2862 Proper shipping nam	Class: 6.1 ne: Vanadium pentoxide	Packing group: I	II		
15. REGULATORY INFOR	RMATION				
SARA 302 Comport The following compo	nents onents are subject to reportir	ng levels establish	ed by SARA Title III,	Section 302: Revision Date	
Vanadium pentoxid	le		1314-62-1	2007-07-01	
SARA 313 Compor	nents				
Vanadium pentoxid	le		CAS-No. 1314-62-1	Revision Date 2007-07-01	
The following comp	onents are subject to reportir	ng levels establish	ed by SARA Title III, CAS-No.	Section 313: Revision Date	
Vanadium pentoxid	le		1314-62-1	2007-07-01	
SARA 311/312 Haz Acute Health Hazar	a rds d, Chronic Health Hazard				
Massachusetts Rig	ght To Know Components				
Vanadium pentoxid	le		CAS-No. 1314-62-1	Revision Date 2007-07-01	
Pennsylvania Righ	nt To Know Components				
Vanadium pentoxid	le		CAS-No. 1314-62-1	Revision Date 2007-07-01	

New Jersey Right To Know Components		
	CAS-No.	Revision Date
Vanadium pentoxide	1314-62-1	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Vanadium pentoxide	1314-62-1	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

Acute toxicity
Acute aquatic toxicity
Chronic aquatic toxicity
Serious eye damage
Harmful if swallowed.
Harmful if swallowed or if inhaled
Causes serious eye damage.
Harmful if inhaled.
May cause respiratory irritation.
Suspected of causing genetic defects.
Suspected of damaging fertility or the unborn child.
Causes damage to organs through prolonged or repeated exposure
Toxic to aquatic life.

HMIS Rating

Health hazard:	4
Chronic Health Hazard:	*
Flammability:	0
Physical Hazard	0
NFPA Rating	
NFPA Rating Health hazard:	3
NFPA Rating Health hazard: Fire Hazard:	3 0

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 5.8

Revision Date: 03/13/2015

Print Date: 01/29/2016

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SAFETY DATA SHEET

Version 3.11 Revision Date 12/01/2015 Print Date 02/18/2016

1. PRODUCT AND COMPANY IDENTIFICATION

1.1	Product identifiers Product name	· Vinyl chloride	
	Product Number Brand Index-No.	: 387622 : Aldrich : 602-023-00-7	
	CAS-No.	: 75-01-4	

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company	: Sigma-Aldrich 3050 Spruce Stro SAINT LOUIS M USA	
Telephone Fax	:	+1 800-325-5832 +1 800-325-5052

1.4 Emergency telephone number

Emergency Phone # : (314) 776-6555

2. HAZARDS IDENTIFICATION

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Flammable gases (Category 1), H220 Gases under pressure (Liquefied gas), H280 Carcinogenicity (Category 1A), H350

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal word



Danger

Hazard statement(s) H220 H280 H350	Extremely flammable gas. Contains gas under pressure; may explode if heated. May cause cancer.
Precautionary statement(s)	Obtain special instructions before use.
P201	Do not handle until all safety precautions have been read and
P202	understood.
P210	Keep away from heat/sparks/open flames/hot surfaces. No smoking.
P281	Use personal protective equipment as required.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.

P377	Leaking gas fire: Do not extinguish, unless leak can be stopped safely.
P381	Eliminate all ignition sources if safe to do so.
P405	Store locked up.
P410 + P403	Protect from sunlight. Store in a well-ventilated place.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS May form explosive peroxides.

3. COMPOSITION/INFORMATION ON INGREDIENTS

3.1 Substances Synonyms

Synonyms	:	Chloroethylene
Formula	:	C ₂ H ₃ CI
Molecular weight	:	62.50 g/mol
CAS-No.	:	75-01-4
EC-No.	:	200-831-0
Index-No.	:	602-023-00-7

Hazardous components

Component	Classification	Concentration
Vinyl chloride		
	Flam. Gas 1; Press. Gas Liquefied gas; Carc. 1A; SA ; H220, H280, H350,	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

4. FIRST AID MEASURES

4.1 **Description of first aid measures**

General advice

Consult a physician. Show this safety data sheet to the doctor in attendance. Move out of dangerous area.

If inhaled

If breathed in, move person into fresh air. If not breathing, give artificial respiration. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water. Consult a physician.

In case of eye contact

Flush eyes with water as a precaution.

If swallowed

Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

5. FIREFIGHTING MEASURES

5.1 Extinguishing media

Suitable extinguishing media

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

5.2 Special hazards arising from the substance or mixture Carbon oxides, Hydrogen chloride gas

5.3 Advice for firefighters

Wear self-contained breathing apparatus for firefighting if necessary.

5.4 Further information

Use water spray to cool unopened containers.

6. ACCIDENTAL RELEASE MEASURES

6.1 Personal precautions, protective equipment and emergency procedures

Use personal protective equipment. Avoid breathing vapours, mist or gas. Ensure adequate ventilation. Remove all sources of ignition. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas. For personal protection see section 8.

6.2 Environmental precautions

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Clean up promptly by sweeping or vacuum.

6.4 Reference to other sections

For disposal see section 13.

7. HANDLING AND STORAGE

7.1 Precautions for safe handling

Avoid inhalation of vapour or mist. Use explosion-proof equipment.Keep away from sources of ignition - No smoking.Take measures to prevent the build up of electrostatic charge. For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Keep container tightly closed in a dry and well-ventilated place.

Contents under pressure. Light sensitive.

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1 Control parameters

Components with workplace control parameters

Component	CÁS-No.	Value	Control parameters	Basis	
Vinyl chloride	75-01-4	TWA	1 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000	
		TWA	1 ppm	USA. ACGIH Threshold Limit Values (TLV)	
	Remarks	Liver damag	е		
		Lung cancer			
		Confirmed h	uman carcinogen		
		STEL	5 ppm	USA. OSHA - TABLE Z-1 Limits for Air Contaminants - 1910.1000	
		TWA	1 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		STEL	5 ppm	USA. Occupational Exposure Limits (OSHA) - Table Z-1 Limits for Air Contaminants	
		See 1910.10)17		
	Potential Occupational Carcinogen See Appendix A		gen		

8.2 Exposure controls

Appropriate engineering controls

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

Personal protective equipment

Eye/face protection

Face shield and safety glasses Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).

Skin protection

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Splash contact

Material: Fluorinated rubber Minimum layer thickness: 0.7 mm Break through time: 120 min Material tested:Vitoject® (KCL 890 / Aldrich Z677698, Size M)

data source: KCL GmbH, D-36124 Eichenzell, phone +49 (0)6659 87300, e-mail sales@kcl.de, test method: EN374

If used in solution, or mixed with other substances, and under conditions which differ from EN 374, contact the supplier of the CE approved gloves. This recommendation is advisory only and must be evaluated by an industrial hygienist and safety officer familiar with the specific situation of anticipated use by our customers. It should not be construed as offering an approval for any specific use scenario.

Body Protection

Complete suit protecting against chemicals, Flame retardant antistatic protective clothing., The type of protective equipment must be selected according to the concentration and amount of the dangerous substance at the specific workplace.

Respiratory protection

Where risk assessment shows air-purifying respirators are appropriate use a full-face respirator with multipurpose combination (US) or type AXBEK (EN 14387) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Control of environmental exposure

Prevent further leakage or spillage if safe to do so. Do not let product enter drains.

9. PHYSICAL AND CHEMICAL PROPERTIES

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: Liquefied gas
b)	Odour	No data available
c)	Odour Threshold	No data available
d)	рН	No data available
e)	Melting point/freezing point	Melting point/range: -153.8 °C (-244.8 °F) - lit.
f)	Initial boiling point and boiling range	-13.4 °C (7.9 °F) - lit.
g)	Flash point	-61.0 °C (-77.8 °F) - closed cup
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or	Upper explosion limit: 33 %(V) Lower explosion limit: 3.6 %(V)

explosive limits

k)	Vapour pressure	No data available
I)	Vapour density	No data available
m)	Relative density	0.911 g/cm3 at 25 °C (77 °F)
n)	Water solubility	No data available
o)	Partition coefficient: n- octanol/water	No data available
p)	Auto-ignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	No data available
Oth No	her safety information data available	

10. STABILITY AND REACTIVITY

10.1 Reactivity

9.2

No data available

10.2 Chemical stability

Stable under recommended storage conditions. Contains the following stabiliser(s): Hydroquinone (>=0 - <=0.0001 %) Phenol (>=0 - <=0.01 %)

- **10.3** Possibility of hazardous reactions No data available
- **10.4** Conditions to avoid Heat, flames and sparks. Extremes of temperature and direct sunlight.
- **10.5** Incompatible materials Chemically active metals, Copper

10.6 Hazardous decomposition products Other decomposition products - No data available In the event of fire: see section 5

11. TOXICOLOGICAL INFORMATION

11.1 Information on toxicological effects

Acute toxicity No data available

LC50 Inhalation - Rat - 0.3 h - 180000 ppm Remarks: Behavioral:Tremor. Behavioral:Convulsions or effect on seizure threshold. Respiratory disorder

Dermal: No data available

No data available

Skin corrosion/irritation No data available

Serious eye damage/eye irritation No data available

Respiratory or skin sensitisation

No data available

Germ cell mutagenicity No data available

Carcinogenicity

This is or contains a component that has been reported to be carcinogenic based on its IARC, OSHA, ACGIH, NTP, or EPA classification.

Human carcinogen.

IARC: 1 - Group 1: Carcinogenic to humans (Vinyl chloride)

NTP: Known to be human carcinogen (Vinyl chloride)

OSHA: OSHA specifically regulated carcinogen (Vinyl chloride)

Reproductive toxicity

No data available

Overexposure may cause reproductive disorder(s) based on tests with laboratory animals.

Specific target organ toxicity - single exposure No data available

Specific target organ toxicity - repeated exposure No data available

Aspiration hazard No data available

Additional Information

RTECS: KU9625000

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, Headache, Nausea, Vomiting, To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

Central nervous system -Stomach - Irregularities - Based on Human Evidence (Phenol) Liver - Irregularities - Based on Human Evidence

12. ECOLOGICAL INFORMATION

12.1 Toxicity No data available

- 12.2 Persistence and degradability No data available
- **12.3 Bioaccumulative potential** No data available
- 12.4 Mobility in soil No data available

12.5 Results of PBT and vPvB assessment

PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Other adverse effects

No data available

13. DISPOSAL CONSIDERATIONS

13.1 Waste treatment methods

Product

Burn in a chemical incinerator equipped with an afterburner and scrubber but exert extra care in igniting as this material is highly flammable. Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material.

Contaminated packaging

Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)

UN number: 1086 Class: 2.1 Proper shipping name: Vinyl chloride, stabilized Reportable Quantity (RQ): 1 lbs

Poison Inhalation Hazard: No

IMDG

UN number: 1086 Class: 2.1 Proper shipping name: VINYL CHLORIDE, STABILIZED EMS-No: F-D, S-U

ΙΑΤΑ

UN number: 1086 Class: 2.1 Proper shipping name: Vinyl chloride, stabilized IATA Passenger: Not permitted for transport

15. REGULATORY INFORMATION

SARA 302 Components

The following components are subject to reporting levels esta	ablished by SARA Title II	I, Section 302:
	CAS-No.	Revision Date
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-07-01
SARA 313 Components		
The following components are subject to reporting levels esta	ablished by SARA Title II	I, Section 313:
	CAŚ-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Massachusetts Right To Know Components		
	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01
Hydroquinone	123-31-9	2007-07-01
Pennsylvania Right To Know Components		
	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
Phenol	108-95-2	2007-07-01
New Jersey Right To Know Components		
	CAS-No.	Revision Date
Vinyl chloride	75-01-4	2007-07-01
California Prop. 65 Components		
WARNING! This product contains a chemical known to the	CAS-No.	Revision Date
State of California to cause cancer. Vinyl chloride	75-01-4	2007-09-28

16. OTHER INFORMATION

Full text of H-Statements referred to under sections 2 and 3.

0

	May displace oxygen and cause rapid suffocation.
Carc.	Carcinogenicity
Flam. Gas	Flammable gases
H220	Extremely flammable gas.
H280	Contains gas under pressure; may explode if heated.
H350	May cause cancer.
Press. Gas	Gases under pressure
SA	Simple Asphyxiant

HMIS Rating

Health hazard:	2
Chronic Health Hazard:	*
Flammability:	4
Physical Hazard	3
NFPA Rating	
Health hazard:	2
Fire Hazard [.]	4

Fire Hazard:	
Reactivity Hazard:	

Further information

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Preparation Information

Sigma-Aldrich Corporation Product Safety – Americas Region 1-800-521-8956

Version: 3.11

Revision Date: 12/01/2015

Print Date: 02/18/2016



SAFETY DATA SHEET Xylene

SECTION 1: Identification of the substance/mixture and of the company/undertaking

Date issued	11.11.2013
1.1. Product identifier	
Product name	Xylene
Chemical name	Xylene
Synonyms	Xylol, dimethyl benzene, xylenol
REACH Reg No.	01-2119488216-32-0000
CAS no.	1330-20-7
EC no.	215-535-7
Index no.	601-022-00-9
Article no.	1300000

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/preparation For the preparation of paints and as a solvent. General purpose cleaner.

1.3. Details of the supplier of the safety data sheet

Manufacturer

Company name	Fred Holmberg & Co AB
Office address	Geijersgatan 8
Postal address	Box 60056
Postcode	S-216 10
City	Limhamn
Country	Sweden
Tel	+46 (0)40 15 79 20
Fax	+46 (0)40 16 22 95
E-mail	info@holmberg.se
Website	http://www.holmberg.se/en/
4.4. England and the lands area	

1.4. Emergency telephone number

Emergency telephone 112 (Europe)

SECTION 2: Hazards identification

2.1. Classification of substance or mixture

Classification according to	Х
67/548/EEC or 1999/45/EC	Х
	R
Classification according to	F
Regulation (EC) No 1272/2008	A
[CLP/GHS]	S

Xi; R38 Xn; R20/21 R10 Flam. Liq. 3; H226; Acute tox. 4; H312; Skin Irrit. 2; H315; Acute tox. 4; H332;

2.2. Label elements

Hazard Pictograms (CLP)



Xylene	Page 2 d
 Signal word	Danger
Hazard statements	H226 Flammable liquid and vapour.
	H312 Harmful in contact with skin.
	H315 Causes skin irritation.
	H332 Harmful if inhaled.
Precautionary statements	P210 Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
	P233 Keep container tightly closed.
	P243 Take precautionary measures against static discharge.
	P280 Wear protective gloves/protective clothing/eye protection/face protection.
	P301 + P310 IF SWALLOWED: Immediately call a POISON CENTER or
	doctor/physician.
	P303 + P361 + P353 IF ON SKIN (or hair): Remove/Take off immediately all
	contaminated clothing. Rinse skin with water/shower.
	P331 Do NOT induce vomiting.
	P403 + P235 Store in a well-ventilated place. Keep cool.
2.3. Other hazards	
Other hazards	Not known.

SECTION 3: Composition/information on ingredients

3.2. MIXtures			
Substance	Identification	Classification	Contents
Xylene	CAS no.: 1330-20-7 EC no.: 215-535-7 Index no.: 601-022-00-9	R10 Xn; R20/21 Xi; R38 Flam. Liq. 3; H226 Acute tox. 4; H332 Acute tox. 4; H312 Skin Irrit. 2; H315 Note : C	75 - 90 %
Ethylbenzene	CAS no.: 100-41-4 EC no.: 202-849-4 Index no.: 601-023-00-4 Synonyms: Ethylbenzene	F; R11 Xn; R20 Flam. Liq. 2; H225 Acute tox. 4; H332	10 - 25 %
Column headings	CAS no. = Chemical Abstracts Service; EU (Einecs or Elincs number) = European inventory of Existing Commercial Chemical Substances; Ingredient name = Name as specified in the substance list (substances that are not included in the substance list must be translated, if possible). Contents given in; %, %wt/wt, %vol/wt, %vol/vol, mg/m3, ppb, ppm, weight%, vol%		
HH/HF/HE	T+ = Very toxic, T = Toxic, C = Cou = Explosive, O = Oxidizing, F+ = E N = Environmental hazard	rrosive, Xn = Harmful, Xi = Irr Extremly flammable, F = Very	itating, E flammable,

SECTION 4: First aid measures

4.1. Description of first aid measures

Inhalation	Move the exposed person to fresh air at once. Get medical attention if any		
	discomion continues.		
Skin contact	Remove contaminated clothes and rinse skin thoroughly with water.		
Eye contact	Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Get medical attention if any discomfort continues.		
Ingestion	NEVER MAKE AN UNCONSCIOUS PERSON VOMIT OR DRINK FLUIDS! Do not induce vomiting. Rinse mouth with water. Get medical attention.		
4.2. Most important symptoms and effects, both acute and delayed			

Information for health personnel

Treat Symptomatically. Do not give victim anything to drink if he is

Xylene unconscious. 4.3. Indication of any immediate medical attention and special treatment needed Specific details on antidotes No recommendation given. SECTION 5: Firefighting measures 5.1. Extinguishing media Suitable extinguishing media Extinguish with alcohol-resistant foam, carbon dioxide, dry powder or water fog. 5.2. Special hazards arising from the substance or mixture Fire and explosion hazards Solvent vapours may form explosive mixtures with air. Hazardous combustion products Fire creates: Carbon monoxide (CO). Carbon dioxide (CO2). 5.3. Advice for firefighters Fire fighting procedures No specific fire fighting procedure given. **SECTION 6: Accidental release measures** 6.1. Personal precautions, protective equipment and emergency procedures Personal protection measures Ensure suitable personal protection (including respiratory protection) during removal of spillages in a confined area. Ventilate well. Stop leak if possible without risk. Avoid contact with skin and eyes. Do not breathe vapour. 6.2. Environmental precautions Environmental precautionary Avoid discharge into drains, water courses or onto the ground. measures 6.3. Methods and material for containment and cleaning up Cleaning method Dam and absorb spillages with sand, earth or other non-combustible material. 6.4. Reference to other sections Other instructions No recommendation given. **SECTION 7: Handling and storage** 7.1. Precautions for safe handling Handling Keep away from heat, sparks and open flame. Take precautionary measures against static discharges. Mechanical ventilation may be required. Protective Safety Measures Advice on general occupational Provide easy access to water supply and eye wash facilities. hygiene 7.2. Conditions for safe storage, including any incompatibilities Keep away from heat, sparks and open flame. Ground container and transfer Storage equipment to eliminate static electric sparks. Store in a cool and wellventilated place. 7.3. Specific end use(s) Specific use(s) Not entered. SECTION 8: Exposure controls/personal protection 8.1. Control parameters

DNEL / PNEC Method of testing Contents DNEL Group: Industrial Exposure route: Inhalation Exposure frequency: Short term (acute) Critical Component: Etylbenzen Value: 289 mg/kg/dag

DNEL	Group: Industrial
	Exposure route: Inhalation
	Exposure frequency: Long term (repeated)
	Critical Component: Etylbenzen
	Type of effect: Systemic effect
	Value: 77 mg/kg/dag
DNEL	Group: Industrial
	Exposure route: Dermal
	Exposure frequency: Long term (repeated)
	Critical Component: Etylbenzen
	Type of effect: Systemic effect
	Value: 180 mg/kg/dag
DNEL	Group: Consumer
	Exposure route: Inhalation
	Exposure frequency: Long term (repeated)
	Critical Component: Etylbenzen
	Type of effect: Systemic effect
	Value: 14,8 mg/kg/dag
DNEL	Group: Consumer
	Exposure route: Dermal
	Exposure frequency: Long term (repeated)
	Critical Component: Etylbenzen
	Type of effect: Systemic effect
	Value: 108 mg/kg/dag
DNEL	Group: Consumer
	Exposure route: Oral
	Exposure frequency: Long term (repeated)
	Critical Component: Etylbenzen
	Type of effect: Systemic effect
	Value: 1,6 mg/kg/dag
DNEL	Group: Industrial
	Exposure route: Inhalation
	Exposure frequency: Short term (acute)
	Critical Component: xylen
	Value: 442 mg/kg/dag
DNEL	Group: Industrial
	Exposure route: Inhalation
	Exposure frequency: Long term (repeated)
	Critical Component: xylen
	Type of effect: Systemic effect
	Value: 221 mg/kg/dag
DNEL	Group: Industrial
	Exposure route: Dermal
	Exposure frequency: Long term (repeated)
	Critical Component: xylen
	l ype of effect: Systemic effect
	Value: 3182 mg/kg/dag
DNEL	Group: Consumer
	Exposure route: Inhalation

Exposure frequency: Short term (acute)

Exposure frequency: Long term (repeated)

Critical Component: xylen Value: 260 mg/kg/dag

Exposure route: Inhalation

Critical Component: xylen Type of effect: Systemic effect

Group: Consumer

D D

<u>Xylene</u>

D D

Xylene		Pag
	Value: 65,3 mg/kg/dag	
DNEL	Group: Consumer	
	Exposure route: Dermal	
	Exposure frequency: Long term (repeated)	
	Critical Component: xylen	
	Type of effect: Systemic effect	
	Value: 1872 mg/kg/dag	
DNEL	Group: Consumer	
	Exposure route: Oral	
	Exposure frequency: Long term (repeated)	
	Critical Component: xylen	
	Type of effect: Systemic effect	
	Value: 12,5 mg/kg/dag	
Exposure guidelines	Country of origin: Sverige	
	Limit value type: NGV 200 mg/m3	
	OEL Short Term Value: 450 mg/m3	
	Source: Nationella hygieniska gränsvärden, AFS 2005:17	
Other Information	Ovanstående NGV resp. KTV gäller både xylen och etylbenzen	
8.2. Exposure controls		
Occupational exposure limits	Provide adequate ventilation. Observe Occupational Exposure Limits	s and
	minimise the risk of inhalation of vapours. Protective gloves and gog	gles are

recommended. Provide eyewash, quick drench.

Safety signs



Respiratory protection

Respiratory protection must be used if air contamination exceeds acceptable

Hand protection

Respiratory protection

Hand protection

Eye / face protection

Eye protection

Skin protection

Skin protection (except hands) Hygiene / Environmental

Specific hygiene measures

level. Use respiratory equipment with gas filter, type A2.

Use protective gloves. Chemical resistant gloves required for prolonged or repeated contact. Gloves of nitrile rubber, PVA or Viton are recommended.

Use safety goggles or face shield in case of splash risk.

Wear appropriate clothing to prevent any possibility of skin contact.

Wash hands after contact.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state Fluid. Colour Colourless. Odour Aromatic. Comments, pH (as supplied) Not relevant. Value: < -48 °C Melting point/melting range Value: 136-145 °C Boiling point / boiling range Value: 27 °C Flash point Value: 13,5 Evaporation rate Explosion limit Value: 1-7,1 % Value: 1 kPa Vapour pressure Test temperature: 20 °C

Xylene

Vapour density	Value: 3,7
Specific gravity	Value: 0,870 kg/m3
	Test temperature: 20 °C
Solubility description	Soluble in: Organic solvents. Not soluble in water.
Partition coefficient: n-octanol/water	Value: 3,15
Spontaneous combustability	Value: > 432-530 °C
Viscosity	Value: < 0,90 mPas

9.2. Other information

SECTION 10: Stability and reactivity

10.1. Reactivity				
Reactivity	Heating may cause a fire.			
10.2. Chemical stability				
Stability	Stable under the prescribed storage conditions.			
10.3. Possibility of hazard	lous reactions			
Possibility of hazardous reactions	Not known.			
10.4. Conditions to avoid				
Conditions to avoid	Avoid heat, flames and other sources of ignition.			
10.5. Incompatible materia	als			
Materials to avoid	Avoid contact with oxidising agents (e.g. nitric acid, peroxides and chromates). Strong acids.			
10.6. Hazardous decompo	osition products			
-				

Method of testing: Kinematisk Test temperature: 25 °C

Hazardous decomposition products Fire creates: Carbon monoxide (CO). Carbon dioxide (CO2).

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Toxicological Information:

Other toxicological data	Acute Toxicity (Oral LD50): mg/kg (oral rat) > 2000
	Acute Toxicity (Inhalation LC50): mg/l (vapours) (4h) > 20
	Acute Toxicity (Dermal LD50): mg/kg Rabbit > 2000

Toxicological data for substances

Potential acute effects

Inhalation	In high concentrations, vapours are narcotic and may cause headache,
	fatigue, dizziness and nausea. Icke klassificerad som aspirationstoxisk (Not
	classified as asp. tox.)
Skin contact	Prolonged or frequent contact may cause redness, itching, eczema and skin
	cracking. Defats the skin.
Eye contact	May irritate and cause redness and pain.
Ingestion	Ingestion of large amounts may cause unconsciousness. However, ingestion
	may cause nausea, headache, dizziness and intoxication. Ingestion may
	cause irritation of the gastrointestinal tract, vomiting and diarrhoea. May cause
	irritation to the mouth and throat.

Delayed effects / repeated exposure

Sensitisation	Not known.	
Chronic effects	None known.	
Carcinogenic, Mutage	enic or Reprotoxic	
Carcinogenicity	None.	
Mutagenicity	Not known.	
Teratogenic properties	Suspected of damaging the unborn child	

Reproductive toxicity

Not known.

SECTION 12: Ecological information

12.1. Toxicity

Acute aquatic, fish	Value: 2 mg/l		
	Method of testing: LC50		
	Fish, species: Roccus saxatilis		
	Duration: 96h		
Acute aquatic, algae	Value: > 3,2 mg/l		
	Method of testing: IC50		
	Algae, species: Selenastrum Capricornum		
	Duration: 72h		
Acute aquatic, Daphnia	Value: 8,5 mg/l		
	Method of testing: EC50		
	Daphnia, species: Daphnia magna		
	Duration: 48h		
12.2. Persistence and deg	radability		
Persistence and degradability description	Lättnedbrytbar av biologiska organismer.		
Chemical oxygen demand (COD)	Value: 5		
	Mathed of testing: COD		

Biological oxygen demand (BOD)

Method of testing: COD Value: 0,55 Method of testing: BOD

12.3. Bioaccumulative potential

Bioaccumulative potential Bioconcentration factor (BCF) Will not bio-accumulate. Value: 22 Method of testing: BCF

12.4. Mobility in soil

The product is insoluble in water and will spread on the water surface.

12.5. Results of PBT and vPvB assessment

PBT assessment results

Mobility

This substance is not classified as PBT or vPvB.

12.6. Other adverse effects

Other adverse effects / Remarks None known.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Specify the appropriate methods of
disposalConfirm disposal procedures with environmental engineer and local regulations.
Absorb in vermiculite or dry sand and dispose of at a licenced hazardous
waste collection point. Liquid components can be disposed of by incineration.Product classified as hazardous
wasteYesPackaging classified as hazardous
wasteYes

SECTION 14: Transport information

14.1. UN number

ADR	1307
RID	1307
IMDG	1307
ICAO/IATA	1307

14.2. UN proper shipping name

ADR	XYLENES

Xvlono

Ayichic				
RID	XYLENES			
IMDG	XYLENES			
ICAO/IATA	XYLENES			
14.3. Transport hazard cl	lass(es)			
ADR	3			
Hazard no.	30			
RID	3			
ADN	33			
IMDG	3			
ICAO/IATA	3			
14.4. Packing group				
ADR	III			
RID	III			
IMDG	III			
ICAO/IATA	III			
4.5. Environmental hazards				
Comment	Not relevant.			
14.6. Special precautions for user				
EmS	F-F, S-D			

14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

SECTION 15: Regulatory information

EC no.

215-535-7

15.1. Safety, health and environmental regulations/legislation specific for the

substance or mixture

Other Label Information	Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 with amendments.	
Legislation and regulations	Dangerous Substance Directive 67/548/EEC. The Chemicals (Hazard Information and Packaging for Supply) Regulations 2009 (S.I 2009 No. 716).	
	The List of Wastes (England) (Amendment) Regulations 2005. (SI 2005 No. 895). Avfallsförordningen (2011:927).	

15.2. Chemical safety assessment

SECTION 16: Other information Hazard symbol



S-phrases

Classification according to Regulation (EC) No 1272/2008 [CLP/GHS] R10 Flammable. R38 Irritating to skin. R20/22 Harmful by inhalation and if swallowed. R38 Irritating to skin. S7 Keep container tightly closed. S16 Keep away from sources of ignition - No smoking. Flam. Liq. 3; H226; Acute tox. 4; H312; Skin Irrit. 2; H315;

	Acute tox. 4; H332;
List of relevant R-phrases (under	R38 Irritating to skin.
headings 2 and 3).	R11 Highly flammable.
	R10 Flammable.
	R20/21 Harmful by inhalation and in contact with skin.
	R20 Harmful by inhalation.
List of relevant H-phrases (Section	H332 Harmful if inhaled.
2 and 3).	H312 Harmful in contact with skin.
	H225 Highly flammable liquid and vapour.
	H226 Flammable liquid and vapour.
	H315 Causes skin irritation.
Responsible for safety data sheet	Fred Holmberg & Co AB





Health	1
Fire	1
Reactivity	1
Personal Protection	E

Material Safety Data Sheet Zinc Metal MSDS

Section 1: Chemical Product and Company Identification		
Product Name: Zinc Metal	Contact Information:	
Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204	Sciencelab.com, Inc. 14025 Smith Rd. Houston, Texas 77396	
CAS# : 7440-66-6	US Sales: 1-800-901-7247	
RTECS: ZG8600000	International Sales: 1-281-441-4400	
TSCA: TSCA 8(b) inventory: Zinc Metal	Order Online: ScienceLab.com	
Cl#: Not applicable.	CHEMTREC (24HR Emergency Telephone), call: 1-800-424-9300	
Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips	International CHEMTREC, call: 1-703-527-3887	
Chemical Name: Zinc Metal	For non-emergency assistance, call: 1-281-441-4400	
Chemical Formula: Zn		

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Zinc Metal	7440-66-6	100

Toxicological Data on Ingredients: Zinc Metal LD50: Not available. LC50: Not available.

Section 3: Hazards Identification

Potential Acute Health Effects: Slightly hazardous in case of skin contact (irritant), of eye contact (irritant), of ingestion, of inhalation.

Potential Chronic Health Effects:

CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. Repeated or prolonged exposure is not known to aggravate medical condition.

Section 4: First Aid Measures

Eye Contact:

Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Get medical attention if irritation occurs.

Skin Contact: Wash with soap and water. Cover the irritated skin with an emollient. Get medical attention if irritation develops.

Serious Skin Contact: Not available.

Inhalation:

If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention.

Serious Inhalation: Not available.

Ingestion:

Do NOT induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. If large quantities of this material are swallowed, call a physician immediately. Loosen tight clothing such as a collar, tie, belt or waistband.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 480°C (896°F)

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances:

Slightly flammable to flammable in presence of open flames and sparks, of heat, of oxidizing materials, of acids, of alkalis, of moisture. Non-flammable in presence of shocks.

Explosion Hazards in Presence of Various Substances:

Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:

Flammable solid. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:

Zinc + NaOH causes ignition. Oxidation of zinc by potassium proceeds with incandescence. Residues from zinc dust /acetic acid reduction operations may ignite after long delay if discarded into waste bins with paper. Incandescent reaction when Zinc and Arsenic or Tellurium, or Selenium are combined. When hydrazine mononitrate is heated in contact with zinc, a flamming decomposition occurs at temperatures a little above its melting point. Contact with acids and alkali hydroxides (sodium hydroxide, postasium hydroxide, calcium hydroxide, etc.) results in evolution of hydrogen with sufficient heat of reaction to ignite the hydrogen gas. Zinc foil ignites if traces of moisture are present. It is water reactive and produces flammable gases on contact with water. It may ignite on contact with water or moist air.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill:

Use appropriate tools to put the spilled solid in a convenient waste disposal container. Finish cleaning by spreading water on the contaminated surface and dispose of according to local and regional authority requirements.

Large Spill:

Flammable solid that, in contact with water, emits flammable gases. Stop leak if without risk. Do not get water inside container. Do not touch spilled material. Cover with dry earth, sand or other non-combustible material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Finish cleaning by spreading water on the contaminated surface and allow to evacuate through the sanitary system.

Section 7: Handling and Storage

Precautions:

Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not breathe dust. Keep away from incompatibles such as oxidizing agents, acids, alkalis, moisture.

Storage:

Keep container tightly closed. Keep container in a cool, well-ventilated area. Keep from any possible contact with water. Do not allow water to get into container because of violent reaction.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:

Use process enclosures, local exhaust ventilation, or other engineering controls to keep airborne levels below recommended exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Personal Protection: Safety glasses. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Gloves.

Personal Protection in Case of a Large Spill:

Splash goggles. Full suit. Dust respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits: Not available.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid. (Lustrous solid. Metal solid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 65.39 g/mole

Color: Bluish-grey

pH (1% soln/water): Not applicable.

Boiling Point: 907°C (1664.6°F)

Melting Point: 419°C (786.2°F)

Critical Temperature: Not available.

Specific Gravity: Not available.

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

lonicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol, acetone.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Excess heat, incompatible materials, moisture

Incompatibility with various substances:

Reactive with oxidizing agents, acids, alkalis. Slightly reactive to reactive with moisture. The product may react violently with water to emit flammable but non toxic gases.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity:

Incompatible with acids, halogenated hydrocarbons, NH4NO3, barium oxide, Ba(NO3)2, Cadmium, CS2, chlorates, Cl2, CrO3, F2, Hydroxylamine, Pb(N3)2, MnCl2, HNO3, performic acid, KClO3, KNO3, N2O2, Selenium, NaClO3, Na2O2, Sulfur, Te, water, (NH4)2S, As2O3, CS2, CaCl2, chlorinated rubber, catalytic metals, halocarbons, o-nitroanisole, nitrobenzene, nonmetals, oxidants, paint primer base, pentacarbonoyliron, transition metal halides, seleninyl bromide, HCl, H2SO4, (Mg +Ba(NO3)2 +BaO2), (ethyl acetoacetate +tribromoneopentyl alcohol. Contact with Alkali Hydroxides(Sodium Hydroxide, Potassium Hydroxide, Calcium Hydroxide, etc) results in evolution of hydrogen. Ammonium nitrate + zinc + water causes a violent reaction with evolution of steam and zinc oxide. May react with water.

Special Remarks on Corrosivity: Not available.

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Inhalation. Ingestion.

Toxicity to Animals:

LD50: Not available. LC50: Not available.

Chronic Effects on Humans: Not available.

Other Toxic Effects on Humans: Slightly hazardous in case of skin contact (irritant), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Not available.

Special Remarks on other Toxic Effects on Humans:

Acute Potential Health Effects: Skin: May cause skin irritation. Dermal exposure to zinc may produce leg pains, fatigue, anorexia and weight loss. Eyes: May cause eye irritation. Ingestion: May be harmul if swallowed. May cause digestive tract irritation with tightness in throat, nausea, vomiting, diarrhea, loss of appetite, malaise, abdominal pain. fever, and chills. May affect behavior/central nervous system and autonomic nervous system with ataxia, lethargy, staggering gait, mild derrangement in cerebellar function, lightheadness, dizzness, irritability, muscular stiffness, and pain. May also affect blood. Inhalation: Inhalation of zinc dust or fumes may cause respiratory tract and mucous membrane irritation with cough and chest pain. It can also cause "metal fume fever", a flu-like condition characterized appearance of chills, headached fever, maliase, fatigue, sweating, extreme thirst, aches in the legs and chest, and difficulty in breathing. A sweet taste may also be be present in metal fume fever, as well as a dry throat, aches, nausea, and vomiting, and pale grey cyanosis. The toxicological properties of this substance have not been fully investisgated.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:

Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: Not available.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Not applicable.

Section 15: Other Regulatory Information

Federal and State Regulations:

New York release reporting list: Zinc Metal Rhode Island RTK hazardous substances: Zinc Metal Pennsylvania RTK: Zinc Metal Florida: Zinc Metal Michigan critical material: Zinc Metal Massachusetts RTK: Zinc Metal New Jersey: Zinc Metal California Director's List of Hazardous Substances: Zinc Metal TSCA 8(b) inventory: Zinc Metal TSCA 12(b) one time export: Zinc Metal SARA 313 toxic chemical notification and release reporting: Zinc Metal CERCLA: Hazardous substances.: Zinc Metal: 1000 lbs. (453.6 kg)

Other Regulations: EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada): Not Available

DSCL (EEC):

R15- Contact with water liberates extremely flammable gases. R17- Spontaneously flammable in air. S7/8- Keep container tightly closed and dry.

HMIS (U.S.A.):

Health Hazard: 1

Fire Hazard: 1

Reactivity: 1

Personal Protection: E

National Fire Protection Association (U.S.A.):

Health: 0

Flammability: 1

Reactivity: 1

Specific hazard:

Protective Equipment:

Gloves. Lab coat. Dust respirator. Be sure to use an approved/certified respirator or equivalent. Safety glasses.

Section 16: Other Information

References: Not available.

Other Special Considerations: Not available.

Created: 10/10/2005 12:18 AM

Last Updated: 11/06/2008 12:00 PM

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ATTACHMENT F

JOBSITE SAFETY INSPECTION CHECKLIST
Jobsite Safety Inspection Checklist

Date:	Inspecto	ed By:
Location:	Project	#:

Check one of the following: A: Acceptable NA: Not Applicable D: Deficiency

	Α	NA	D	Remark
1. CHASP available onsite for inspection?				
2. Health & Safety Compliance agreement (in CHASP)				
appropriately signed by Langan employees and				
contractors?				
3. Hospital route map with directions posted on site?				
4. Emergency Notification List posted on site?				
5. First Aid kit available and properly stocked?				-
6. Personnel trained in CPR/First Aid on site?				
7. MSDSs readily available, and all workers				
knowledgeable about the specific chemicals and				
compounds to which they may be exposed?				
8 Appropriate PPE being worn by Langan employees and contractors?				
9. Project site safe practices ("Standing Orders") posted?				
10. Project staff have 40-hr./8-hr./Supervisor HAZWOPER				
training?				
11. Project staff medically cleared to work in hazardous				
waste sites and fit-tested to wear respirators, if needed?				
12. Respiratory protection readily available?				
13. Health & Safety Incident Report forms available?				
14. Air monitoring instruments calibrated daily and results				
recorded on the Daily Instrument Calibration check				
sheet?				
15. Air monitoring readings recorded on the air monitoring				
data sheet/field log book?				
16. Subcontract workers have received 40-hr./8-hr./Spvsr.				
HAZWOPER training, as appropriate?				
17. Subcontract workers medically cleared to work on				
site, and fit-tested for respirator wear?				
18. Subcontract workers have respirators readily				
available?				
19. Mark outs of underground utilities done prior to				
initiating any subsurface activities?				
20. Decontamination procedures being followed as				
outlined in CHASP?				
21. Are tools in good condition and properly used?				
22. Drilling performed in areas free from underground				
objects including utilities?				

23. Adequate size/type fire extinguisher supplied?		
24. Equipment at least 20 feet from overhead		
powerlines?		
25. Evidence that drilling operator is responsible for the		
safety of his rig.		
26. Trench sides shored, layer back, or boxed?		
27. Underground utilities located and authorities		
contacted before digging?		
28. Ladders in trench (25-foot spacing)?		
29. Excavated material placed more than 2 feet away		
from excavation edge?		
30. Public protected from exposure to open excavation?		
31. People entering the excavation regarding it as a		
permit-required confined space and following appropriate		
procedures?		
32. Confined space entry permit is completed and		
posted?		
33. All persons knowledgeable about the conditions and		
characteristics of the confined space?		
34. All persons engaged in confined space operations		
have been trained in safe entry and rescue (non-entry)?	 	
35. Full body harnesses, lifelines, and hoisting apparatus		
available for rescue needs?		
36. Attendant and/or supervisor certified in basic first aid		
and CPR?		
37. Confined space atmosphere checked before entry		
and continuously while the work is going on?		
38. Results of confined space atmosphere testing		
recorded?		
39. Evidence of coordination with off-site rescue services		
to perform entry rescue, if needed?		
40. Are extension cords rated for this work being used		
and are they properly maintained?		
41. Are GFCIs provided and being used?		

Unsafe Acts:

Notes:

ATTACHMENT G

JOB SAFETY ANALYSIS FORM

LANGAN	Job Safet Healt	y Analysis (JSA) n and Safety
JSA TITLE:	DAT C	E CREATED: REATED BY:
JSA NUMBER:	REVI	SION DATE: EVISED BY:
Langan employees must review and revise Employees must provide their signatures of hazards associated with this work and will	e the Job Safety Analysis (JSA) as needed to a on the last page of the JSA indicating they ha I follow the provided preventive or corrective	ddress the any site specific hazards not identified. ve review the JSA and are aware the potential measures.
PERSONAL PROTECTIVE EQUIPMENT REQ	UIRED: (PPE): Required	leeded
□ Steel-toed boots	□ Nitrile gloves	Dermal Protection (Specify)
□ Long-sleeved shirt	Leather/ Cut-resistant gloves	□ High visibility vest/clothing
□ Safety glasses	□Face Shield	□ Hard hat
ADDITIONAL PERSONAL PROTECTIVE EQU	JIPMENT NEEDED (Provide specific type(s) or	descriptions)
□ Air Monitoring:	□ Respirators:	□ Other:
JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE OR CORRECTIVE ACTION
1.	1.	1a.
	2.	2a. 2b.
2.	1.	1
Additional items identified in the field.		
Additional Items.		
If additional items are identifie about the change and docume	d during daily work activities, pl nt on this JSA.	ease notify all relevant personnel

Job Safety Analysis (JSA) Health and Safety

JSA Title: General Construction Activities

JSA Number: JSA010-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PE	PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):					
\boxtimes	Safety Shoes	☑ Long Sleeves	Safety Vest (Clas	s 2)	🛛 Hard Hat	Hearing Protection
\boxtimes	Safety Glasses	Safety Goggles	Face Shield		☑ Nitrile Gloves	PVC Gloves
\boxtimes	Leather Gloves	Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
	Insect/Animal Repellent	Ivy Blocker/Cleaner	☐ Traffic Cones/Signs		Life Vest/Jacket	
	Other:	· · · · ·			·	
	JOB STEPS	POTENTIAL HAZA	RDS		PREVENTATIVE / CORRI	ECTIVE ACTION
1.	Transport equipment to	1. Back Strain		1. Use p	roper lifting techniques / Use whe	eled transport
,	work area	2. Slips/ Trips/ Falls	1	2. Minim	ize distance to work area / Have u	unobstructed path to work area /
		3. Traffic		Follov	v good housekeeping procedures	
		Cuts/abrasions from equipme	nt	3. Wear	proper PPE (high visibility vest or	clothing)
		5. Contusions from dropped equ	ipment	4. Wear	proper PPE (leather gloves, long	sleeves)
0				5. Wear	proper PPE (safety shoes)	
2.	Installation of piping from	1. Pinch fingers when connectir	ig pipes	1. Wea	proper PPE (leather gloves)	e 11 1 1
	vapor wells to skid	2. Slips/ Trips/ Falls		2. Be av	are of potential trip hazards / Pra	ctice good housekeeping
	connections and from	3. Machinery Hazards		proce	dures / Mark significant below-gra	de nazards (I.e. noles, trenches)
	discharge piping to enluent			With S	arety cones of spray paint	in onto distance from one ration
:	SIACK			3. wear mach	inery	in sale distance from operating
3.	Remediation equipment	1. Back strain when lifting heavy	equipment	1. Use p	roper lifting techniques / Use whe	eled transport / Minimize distance
i	installation	2. Slips/ Trips/ Falls		to ver	licle	
		3. Traffic		2. Be av	are of potential trip hazards / Pra	ctice good housekeeping
				proce	dures / Mark significant below-gra	de hazards (i.e. holes, trenches)
				With S	afety cones or spray pain	
4		1 Oline/Trine/Falle		3. Wear	proper PPE (safety vest)	w good housely oping
4.	All activities	1. Slips/ Trips/ Fails	na during manual	1. Be aw	dures / Mark significant bazards / Folic	w good nousekeeping
		2. Hand Injuries, cuts of laceratic	ins during manual		t for ipaged/sharp edges, and rou	ah ar slippony surfaces / Keep
		3 Foot injuries		z. mspec finder	s away from pinch points / Wine o	ff greasy wet slippery or dirty
		4 Back injuries		ohiec	's before handling / Wear leather/	cut-resistant doves
		5. Traffic		3. Wear	angan approved safety shoes	out robotant giovoo
		6. Wildlife: Stray dogs. Mice/rats	Vectors (i.e.	4. Use n	oper lifting techniques / Consider	load location, task repetition, and
		mosquitoes, bees, etc.)		load v	veigh when evaluating what is safe	e or unsafe to lift / Obtain
		7. High Noise levels		assis	ance when possible	

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd)	 8. Overhead hazards 9. Heat Stress/ Cold Stress 10. Eye Injuries 	 Wear high visibility clothing & vest / Use cones or signs to designate work area Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed Wear hearing protection Wear hard hat / Avoid areas were overhead hazards exist. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

Job Safety Analysis (JSA) Health and Safety

JSA Title: Subsurface Investigation

JSA Number: JSA030-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQU	JIPMENT (Required or to be wor	n as needed):		
Safety Shoes	🛛 Long Sleeves	Safety Vest (Class 2)	🛛 Hard Hat	Hearing Protection
Safety Glasses	Safety Goggles	Face Shield	Nitrile Gloves	PVC Gloves
☑ Leather Gloves	🛛 Cut Resist. Gloves	Fall Protection	Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	Traffic Cones/Signs	Life Vest/Jacket	
🛛 Other: Dielectric Overshoes, Su	In Block			

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
5. Transport equipment to work area	 Back/strain Slip/Trip/Falls Traffic Cuts/abrasions/contusions from equipment Accidents due to vehicle operations 	 Use proper lifting techniques/Use wheeled transport Minimize distance to work area/unobstructed path to work area/follow good housekeeping procedures Wear proper PPE (high visibility vest or clothing) Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes) Observe posted speed limits/ Wear seat belts at all times
6. Traffic	1. Hit by moving vehicle	1. Use traffic cones and signage/ Use High visibility traffic vests and clothing/ Caution tape when working near active roadways.
7. Field Work (drilling, resistivity testing, and inspection)	 Biological Hazards: insects, rats, snakes, poisonous plants, and other animals Heat stress/injuries Cold Stress/injuries High Energy Transmission Lines Underground Utilities Electrical (soil resistivity testing) 	 Inspect work area to identify biological hazards. Wear light colored long sleeve shirt and long pants/ Use insect repellant as necessary/ Beware of tall grass, bushes, woods and other areas where ticks may live/ Avoid leaving garbage on site to prevent attracting animals/ Identify and avoid contact with poisonous plants/Beware of rats, snakes, or stray animals. Wear proper clothing (light colored)/ drink plenty of water/ take regular breaks/use sun block Wear proper clothing/ dress in layers/ take regular breaks. Avoid direct contact with high energy transmission lines/ position equipment at least 15 feet or as required by PSE&G from the transmission lines/ wear proper PPE (dielectric overshoes 15 kV minimum rating). Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		16. See AGI Sting R1 operating manual for specific concerns during operating instrument
8.All activities	 Slips/ Trips/ Falls Hand injuries, cuts or lacerations during manual handling of materials Foot injuries Back injuries Traffic Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) High Noise levels Overhead hazards Heat Stress/ Cold Stress Eye Injuries 	 Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves Wear Langan approved safety shoes Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible Wear high visibility clothing & vest / Use cones or signs to designate work area Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed Wear hard hat / Avoid areas were overhead hazards exist. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
<u>Reviewed by:</u>		

	LANGAN	V		Job Safety Health	y Analysis (JSA) and Safety
JSA Title: Excavation Ov	versight				<u>S</u> – Stop, what has changed?
JSA Number: JSA041-01				S	E T – Think about the task
A Job Safety Analysis (JSA)	must identify all job steps rec	quired to complete th performing the job st	e task, the		
preventative/corrective action	is required to reduce/mitigate	the identified potenti	al hazards.	TAKE 5	
Employees must certify that the	ney have either prepared the JS	SA or have reviewed the sk and will follow the	he JSA and		S <u>P</u> – Plan safe approach
preventive/corrective actions.	Prior to the start of any wor	k "TAKE 5" and cone	duct a Last		<u>S</u> - Start task / Stop & regroup
Minute Risk Assessment.					
PERSONAL PROTECTIVE EQ	UIPMENT (Required or to be w	orn as needed):			
Safety Shoes	☐ Long Sleeves	Safety Vest (Cla	ass 2)	🛛 Hard Hat	Hearing Protection
Safety Glasses	□ Safety Goggles	Face Shield		☑ Nitrile Gloves	PVC Gloves
Leather Gloves	☑ Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	Traffic Cones/S	igns	Life Vest/Jacket	
Other:			-		
JOB STEPS	POTENTIAL HA	ZARDS		PREVENTATIVE / COR	RECTIVE ACTION
JOB STEPS 9. Transport equipment to	POTENTIAL HA	ZARDS	6. Us	PREVENTATIVE / COR se proper lifting techniques / Us	RECTIVE ACTION se wheeled transport
JOB STEPS 9. Transport equipment to work area	POTENTIAL HA	ZARDS	6. Us 7. Mi	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area /	RECTIVE ACTION se wheeled transport Have unobstructed path to work
JOB STEPS 9. Transport equipment to work area	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion	S from equipment	6. Us 7. M ar 8 W	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility)	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures (est or clothing)
JOB STEPS 9. Transport equipment to work area	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion	S from equipment	6. Us 7. M ar 8. W 9. W	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures vest or clothing) s, long sleeves, safety shoes)
JOB STEPS 9. Transport equipment to work area	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion	AZARDS	6. Us 7. M ar 8. W 9. W	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures vest or clothing) s, long sleeves, safety shoes)
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over elements	S from equipment	6. Us 7. M ar 8. W 9. W 1. Ensure y	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end	S from equipment	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility visibil	RECTIVE ACTION See wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment.
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse	AZARDS s from equipment mployee	6. Us 7. Mi ar 8. W 9. W 1. Ensure y behind e 2. Wear pro 1. Use pro	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility v ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping	RECTIVE ACTION se wheeled transport Have unobstructed path to work p procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space	AZARDS s from equipment mployee	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro- 1. Use pr situate	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in exc	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil	AZARDS s from equipment mployee	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro- situate inspec	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in ex- ted excavation prior to allow en	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter.
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil	AZARDS s from equipment mployee	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro situate inspec 2. Langa 2. Soil ar	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in exc ted excavation prior to allow er n employees are not authorized	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter. d to enter a confined space; icont from edup of execution
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12 Excavated soil	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil	AZARDS s from equipment mployee	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro 1. Use pro 3. Soil ar 1. Use pro	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility viet ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in exi- ted excavation prior to allow er n employees are not authorized ad equipment is kept at least 2 for per equipment to monitor exca	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter. d to enter a confined space; feet from edge of excavation wated soil for contaminates; ensure
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12.Excavated soil	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil 1. Hazardous substances	AZARDS s from equipment mployee	6. Us 7. Mi ar 8. W 9. W 1. Ensure y behind e 2. Wear pro 1. Use pro situate inspec 2. Langa 3. Soil ar 1. Use pro levels do n	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in exc ted excavation prior to allow er n employees are not authorized ad equipment is kept at least 2 to per equipment to monitor excap ot exceed PEL's for contaminat	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter. d to enter a confined space; feet from edge of excavation wated soil for contaminates; ensure tes; Wear proper PPE
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12.Excavated soil 13. All activities	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil 1. Hazardous substances 21. Slips/ Trips/ Falls	AZARDS s from equipment mployee	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro 1. Use pro situate inspec 2. Langa 3. Soil ar 1. Use pro levels do n 27. Be awa	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves /ou have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in ex- ted excavation prior to allow er n employees are not authorized in equipment is kept at least 2 for per equipment to monitor exca ot exceed PEL's for contaminat re of potential trip hazards / Fo	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter. d to enter a confined space; eet from edge of excavation wated soil for contaminates; ensure tes; Wear proper PPE llow good housekeeping
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12.Excavated soil 13. All activities	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil 1. Hazardous substances 21. Slips/Trips/Falls 22. Hand injuries, cuts or lace	AZARDS s from equipment mployee erations during	6. Us 7. Mi ar 8. W 9. W 1. Ensure y behind e 2. Wear pro- 1. Use pro- situate inspec 2. Langar 3. Soil ar 1. Use pro- levels do mi 27. Be awa proceco	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in ex- ted excavation prior to allow er n employees are not authorized per equipment is kept at least 2 for per equipment to monitor excap ot exceed PEL's for contaminat re of potential trip hazards / Fo lures/ Mark significant hazards	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has nployees to enter. d to enter a confined space; feet from edge of excavation wated soil for contaminates; ensure tes; Wear proper PPE llow good housekeeping
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12.Excavated soil 13. All activities	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil 1. Hazardous substances 21. Slips/Trips/Falls 22. Hand injuries, cuts or lace manual handling of mater 23. Eost injuries	AZARDS s from equipment mployee erations during ials	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear profine inspec 2. Langai 3. Soil ar 1. Use profine inspect do nu 27. Be awa procec 28. Inspect	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility viet ear proper PPE (leather gloves you have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in ex- ted excavation prior to allow er n employees are not authorized ad equipment is kept at least 2 for per equipment to monitor exca ot exceed PEL's for contaminat re of potential trip hazards / Fo lures/ Mark significant hazards for jagged/sharp edges, and re	RECTIVE ACTION se wheeled transport Have unobstructed path to work g procedures vest or clothing) a, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has mployees to enter. d to enter a confined space; feet from edge of excavation wated soil for contaminates; ensure res; Wear proper PPE llow good housekeeping pugh or slippery surfaces / Keep
JOB STEPS 9. Transport equipment to work area 10.Earth Moving Equipment 11.Excavation 12.Excavated soil 13. All activities	POTENTIAL HA 6. Back Strain 7. Slips/Trips/Falls 8. Traffic 9. Cuts/abrasions/contusion 1. Equipment running over end 4. Excavation collapse 5. Confined space 6. Soil 1. Hazardous substances 21. Slips/Trips/Falls 22. Hand injuries, cuts or lace manual handling of mater 23. Foot injuries 24. Back injuries	AZARDS s from equipment mployee erations during ials	6. Us 7. M ar 8. W 9. W 1. Ensure y behind e 2. Wear pro- 1. Use pro- situate inspec 2. Langar 3. Soil ar 1. Use pro- levels do m 27. Be awa procec 28. Inspect fingers objects	PREVENTATIVE / COR se proper lifting techniques / Us inimize distance to work area / ea / Follow good housekeeping ear proper PPE (high visibility viet ear proper PPE (leather gloves /ou have direct line of sight with equipment; maintain a safe dista oper PPE (high vis vest/clothing oper shoring/benching/sloping d in excavation; no water in exit ted excavation prior to allow er n employees are not authorized ad equipment is kept at least 2 for per equipment to monitor exca ot exceed PEL's for contaminal re of potential trip hazards / Fo lures/ Mark significant hazards for jagged/sharp edges, and ro a way from pinch points / Wipe s before handling / Wear leather	RECTIVE ACTION se wheeled transport Have unobstructed path to work procedures vest or clothing) s, long sleeves, safety shoes) n operator of equipment; don't walk ance away from equipment. g) techniques; Ladder is properly cavation; competent person has inployees to enter. d to enter a confined space; eet from edge of excavation wated soil for contaminates; ensure tes; Wear proper PPE llow good housekeeping bugh or slippery surfaces / Keep off greasy, wet, slippery or dirty r/ cut-resistant gloves

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	 26. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 27. High Noise levels 28. Overhead hazards 29. Heat Stress/ Cold Stress 30. Eye Injuries 	 30. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 31. Wear high visibility clothing & vest / Use cones or signs to designate work area 32. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 33. Wear hearing protection 34. Wear hard hat / Avoid areas were overhead hazards exist. 35. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 36. Wear safety glasses
Additional items.		
Additional Items identified while in the field. (Delete row if not needed.)		

Print Name	Sign Name	Date			
Prepared by:	Prepared by:				
<u>Reviewed by:</u>					

Job Safety Analysis (JSA) Health and Safety

JSA Title: Field Sampling

JSA Number: JSA022-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions.

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
Safety Shoes	🛛 Long Sleeves	Safety Vest (Class 2)	🛛 Hard Hat	Hearing Protection
Safety Glasses	Safety Goggles	Face Shield	☑ Nitrile Gloves	PVC Gloves
Leather Gloves	Cut Resist. Gloves	Fall Protection	Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	Traffic Cones/Signs	Life Vest/Jacket	
Other:				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
14.Unpack/Transport equipment to work area.	10.Back Strains 11.Slip/Trips/Falls 12.Cuts/Abrasions from equipment 13.Contusions from dropped equipment	 Use proper lifting techniques/Use wheeled transport Minimize distance to work area/Unobstructed path to work area/follow good housekeeping procedures. Mark slip/trip/fall hazards with orange safety cones. Wear proper PPE (leather gloves, long sleeves). Wear proper PPE (Langan approved safety shoes).
15.Initial Site Arrival-Site Assessment	2. Traffic	 Situational awareness (be alert of your surroundings). Secure area from through traffic.
16.Surface Water Sampling	7. Contaminated media. Skin/eye contact with biological agents and/or chemicals.	 Wear appropriate PPE (Safety glasses, appropriate gloves). Review MSDS for all chemicals being.
17.Sampling from bridges	1. Struck by vehicles	 Wear appropriate PPE (Safety Vest). Use buddy system and orange safety cones.
 Icing of Samples/ Transporting coolers/equipment from work area. 	31. Back Strains32. Slips/Trips/Falls33. Cuts/Abrasions from equipment34. Pinch/Crushing Hazards.	 37. Drain coolers of water. Use proper lifting techniques. Use wheeled transport. 38. Have unobstructed path from work area. Aware of surroundings. 39. Wear proper PPE (Leather gloves, long sleeves) 40. Wear proper PPE (Leather gloves, long sleeves)
19. Site Departure	1. Contaminated PPE/Vehicle	 Contaminated PPE should be disposed of on-site. Remove boots and soiled clothing for secure storage in trunk. Wash hands promptly.
20. All activities	 Slips/ Trips/ Falls Hand injuries, cuts or lacerations during manual handling of materials 	1. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
Additional items.	 Foot injuries Back injuries Traffic Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) High Noise levels Overhead hazards Heat Stress/ Cold Stress Eye Injuries 	 Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves Wear Langan approved safety shoes Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible Wear high visibility clothing & vest / Use cones or signs to designate work area Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed Wear hard hat / Avoid areas were overhead hazards exist. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	<u>Sign Name</u>	Date	
Prepared by:			
Reviewed by:			

LANGAN	Job Safety Analysis (JSA) Health and Safety
JSA Title: COVID-19 Awareness – Site Work JSA Number: JSA046-02 A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.	S Stop, what has changed? I Think about the task E Evaluate potential hazards P Plan safe approach S Start task / Stop & regroup

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):				
Safety Boots	Long Sleeves	Safety Vest (Class 2)	Hard Hat	Hearing Protection
□ Safety Glasses	Safety Goggles	□ Face Shield	□ Nitrile Gloves	PVC Gloves
Leather Gloves	Cut Resist. Gloves	Fall Protection	Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	□ Traffic Cones/Signs	Life Vest/Jacket	
☑ Other: Alcohol-based hand sanitizer, disinfectant wipes/spray				

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
1. All Activities	1. Transmittal/exposure of COVID-19	 Ask yourself and your managers – is this work essential? Can this be done remotely? Stay home if sick or showing symptoms of COVID-19 (e.g. fever, cough, etc.). Carry nitrile gloves, alcohol-based hand sanitizer, face coverings and disinfectant wipes/spray during field work. Check federal, state, and/or local travel restrictions prior to travel. Immediately notify Coronavirus Task Force (Using reporting buttons) if you display symptoms of COVID-19. Symptoms include cough, shortness of breath or difficulty breathing, fever or chills, sore throat, new loss of taste or smell, fatigue, muscle or body aches, headache, congestion or runny nose, nausea or vomiting, or diarrhea. Notify Coronavirus Task Force (Using reporting buttons) if you had close contact with an individual who tested positive or displayed symptoms of COVID-19. Do not touch your face, to the extent possible. Wear face coverings when around other worker to minimize spread of COVID-19. (May be required in certain states or locations.)

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		 Practice social distancing, maintaining at least 6 feet of distance between yourself and others. Avoid gatherings of more than 10 people. Limit, to the extent possible, contact with public items/objects. Clean your hands frequently with soap and water for at least 20 seconds especially after you have been in a public place, or after blowing your nose, coughing, sneezing, or using the rest room. If soap and water are not readily available, use a hand sanitizer that contains at least 60% alcohol. Cover all surfaces of your hands and rub them together until they feel dry. Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. Clean and disinfect frequently touched surfaces daily, for example, cell phones, computer equipment, headsets, tables, doorknobs, light switches, countertops, bandles, desks, toilets faucets, and sinks
2. Travel to Jobsite	 Transmittal/exposure of COVID-19 between passengers Transmittal/exposure of COVID-19 from previous occupants (rental and fleet vehicles) Transmittal/exposure of COVID-19 while refueling 	 Limit the number of occupants to each vehicle to 2 people. Employees should sit as far away from each other as possible. Disinfect high "hand-traffic" areas of the vehicle: Door handles, steering wheel, turn signal and control rods, dashboard controls, seatbelts, armrests, etc. To the extent possible, do not use recycled air for heat/AC and travel with the windows open. Use hand sanitizer before and after pumping gas and only return to the inside of the vehicle after refueling is complete. Wear nitrile gloves if available or disinfect the key pad, pump handle, and fuel grade button prior to use. Recommend face coverings are worn to minimize spread of COVID-19.
 Conduct Tailgate Safety Meeting & Complete H&S Paperwork 	1. Transmittal/exposure of COVID-19 between meeting participants	 Practice social distancing, maintaining at least 6 feet of distance between yourself and others. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, Hold meetings outside and keep in mind wind direction. To the extent possible, remain cross-wind from other people. Designate a single person to maintain sign-in sheets/permits throughout the day to limit the passing of pens/clipboards between people. Each person should complete their own JSA, even if they are completing similar tasks as others in order to limit the passing of paper/pens/clipboards between people. Include COVID-19 topics and prevention measures in safety meetings.
4. Conduct Site Work	 Transmittal/exposure of COVID-19 between site workers and public. 	 Practice social distancing maintaining 6 feet of distance between yourself and others. Recommend face coverings are worn when around other workers to minimize spread of COVID-19, To the extent possible, do not interact with the public. If it is necessary, politely explain you are practicing social distance and request they stay at least 6 feet away and they do not attempt to pass objects to you. Wear nitrile gloves during site work underneath the appropriate gloves for your task. Utilize appropriate decontamination procedures, securely bag all waste (including nitrile gloves) generated during site work and dispose of.

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		 Do not share tools. Each person should be equipped with the tools to complete their task or tasks should be divided to remove the need to share tools. If tools must be shared, surfaces should be disinfected. Clean and disinfect surfaces of rental tools and equipment upon receipt. To the extent possible rent equipment from Langan's internal equipment reservation center, where cleaning/disinfecting procedures can be verified.
5. Use of Construction Trailers	1. Transmittal/exposure of COVID-19 between site workers and others.	 Avoid use of shared trailers, if possible. Minimize trailer use to essential personnel. Practice social distancing; maintaining 6 feet of distance between yourself and others in trailer. Clean and disinfect areas including desks, phones, chairs and other common areas, before and after use.
 Purchasing Food from a Restaurant 	 Transmittal/exposure of COVID-19 from other customers, staff, surfaces. 	 To the extent possible, bring your own food. If you must visit a restaurant, call ahead for take-out or "contactless delivery". Do not dine in. When picking up food, follow guidelines for <u>Job Step #8: Purchasing Supplies</u> <u>at Retail/Shipping Centers</u>. Wash hands before and after eating.
7. Smoking Cigarettes	 Transmittal/exposure of COVID-19 by touching mouth with hands 	 Cigarette smokers maybe at greater risk of complications arising from COVID-19. Nicotine patches/lozenges/gum, smoking cessation programs, and prescription medications may aid in "kicking the habit" if you decide to quit. Wash hands thoroughly before and after smoking. Discard cigarette butts properly. Do not light cigarettes from others and do not give cigarettes to others.
8. Hotel Stay	1. Transmittal/exposure of COVID-19 from previous occupants, hotel staff, common areas.	 Verify the hotel chain/brand has modified cleaning procedures to reflect risk of COVID- 19. Most hotel companies have issued statements on their websites and in email blasts reflecting these new procedures. Use the front door, and not peripheral entrances. Front doors of hotels are generally automatic. Request ground floor room to avoid elevator use and a room that has not be utilized in 48-72 hours. If elevator use is required, do not directly touch elevator buttons with your hands. Do not ride elevators with other people, to the extent possible. Bring disinfecting wipes or sanitizing spray. Upon arrival, disinfect high "hand-traffic" areas of the hotel room: Door handles, light switches, shower/sink faucet handles, TV remote, curtain/blind handles. Clean these surfaces daily. Place the "Do Not Disturb" Sign on your door to prevent people (housekeeping) from entering your room. Avoid common spaces and hotel sponsored events where crowds will be present. Confirm hotel cleaning procedures have been modified to address COVID-19. Confirm no COVID-19 cases have occurred in hotel
9. Purchasing Supplies at Retail/Shipping Centers	 Transmittal/exposure of COVID-19 from other customers, staff, surfaces. 	 Plan your travel to limit the need to visit retail/shipping centers. Practice social distancing, maintaining at least 6 feet of distance between yourself and others. If the store is too crowded/small, consider visiting another store or returning at a different time. Avoid high "hand-traffic" items/areas like door handles (i.e. use your shoulder, hip/butt, or open with a disposable napkin/paper towel), credit cards terminals (i.e. use Apple/Android pay if available), shopping carts/baskets (i.e. bring your own shopping

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		 bags), counter tops (i.e. ask clerk if you can hold the items while they are scanned) and bulk/buffet items (i.e. just avoid them). 4. Disinfect your hands before and after visiting a retail/shipping center.

Print Name	Sign Name	Date					
Prepared by:	Prepared by:						
Reviewed by:	Reviewed by:						

JSA Title: Tieback Testing JSA Number: JSA036-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.





DEDSONAL DROTECTIVE FOLIDMENT (Poguized of to be worn as peeded):					
Safaty Shoos		Safaty Voet (Cla	2)		Hearing Protection
Safety Glasses	□ Safety Goggles				
Leather Gloves	Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	☐ Traffic Cones/Si	gns	Life Vest/Jacket	Air Monitoring
Other:					
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORREC	CTIVE ACTION
21.Transport equipment to work site	 Back Strain Slips/ Trips/ Falls Traffic Cuts/Abrasions/Contusions from equipment 		 Use proper lifting techniques/ Use wheeled transport Minimize distance to work area/ Have unobstructed path to work area/ Follow good housekeeping procedures/ Mark tripping hazards with spray paint or cones. Wear proper PPE (high visibility vest or clothing) Wear proper PPE (leather gloves, long sleeves, Langan approved safety shoes) 		
22.Check calibration curve for the testing equipment	1. No hazards				
23.Alignment of hydraulic ram by contractor	 Hand injuries(pinch points) Equipment fall hazard (2 to 3 ft. drop) Airborne objects 		 Keep fi gloves) Stay av Wear p projecti 	ngers and hands out of pinch poin vay from equipment until load has roper PPE (safety glasses) at all t on area	t areas/ Wear proper PPE (work been stabilized and secured. imes/ Stand to side of possible
24.Conduct proof or performance test	 Hand injuries (pinch points) Airborne objects from Hydrau 	lic ram	 Keep fi (leathe Stand a from th shield) 	ngers and hands away from pinch r gloves) away to safe side of the shoring be e tieback pocket)/ Wear proper PF	point areas/ Wear proper PPE eam (opposite side of the beam PE (safety glasses and face

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
25.Conduct Lift-Off test	 Hand injuries (pinch points) Airborne objects (splintered wedges) Slips/Trips/ Falls 	 Keep fingers and hands away from pinch point areas/ Wear proper PPE (leather gloves) Wear proper PPE (safety glasses) at all times/ Stand to safe side of the shoring beam (opposite side of the beam from the tieback pocket)
6. All activities	 Slips/ Trips/ Falls Hand injuries, cuts or lacerations during manual handling of materials Foot injuries Back injuries Traffic Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) High Noise levels Overhead hazards Heat or cold injuries Eye Injuries 	 47. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with caution tape, cones, or spray paint 48. Inspect for jagged/sharp edges, and rough or slippery surfaces/ Keep fingers away from pinch points/ Wipe off greasy, wet, slippery or dirty objects before handling/ Wear leather or cut-resistant gloves 49. Wear proper PPE (Langan approved safety shoes) 50. Use proper lifting techniques/ Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to life / Obtain assistance when possible 51. Wear high visibility clothing & vest/ Use cones or signs to designate work area 52. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray animals/ Carry and use animal repellant when needed/ Use bug spray when needed 53. Wear hearing protection 54. Wear hard hat/ Avoid areas were overhead hazards exist. 55. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather)/ Drink plenty of fluids to avoid dehydration/ Take breaks as necessary to avoid heat or cold stress 10. Wear safety glasses
Additional items.		

Print Name	Sign Name	<u>Date</u>
Prepared by:		
Antonio R. Mencarini		
Scott A. Walker		
<u>Reviewed by:</u>		

JSA Title: Subsurface Investigation JSA Number: JSA030-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute **Risk Assessment.**





			•

<u>S</u> - Start task / Stop & regroup

PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):						
Safety Shoes	🛛 Long	ng Sleeves 🛛 🖾 Safety Vest (Cla		iss 2)	Hard Hat	Hearing Protection
Safety Glasses	🛛 Safet	ty Goggles	Face Shield		Nitrile Gloves	PVC Gloves
☑ Leather Gloves	🛛 Cut F	Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	🗌 Ivy B	locker/Cleaner	Traffic Cones/Si	gns	Life Vest/Jacket	
Other: Dielectric Overshoes, Su	n Block					
JOB STEPS		POTENTIAL	HAZARDS		PREVENTATIVE / CORREC	CTIVE ACTION
26.Transport equipment to work	area	 18.Back/strain 19.Slip/Trip/Falls 20.Traffic 21.Cuts/abrasions/contusions from equipment 22.Accidents due to vehicle operations 		 Use pro- good h Minimiz good h Wear p Wear p Shoes) Observ 	oper lifting techniques/Use wheele ze distance to work area/unobstrue ousekeeping procedures roper PPE (high visibility vest or c roper PPE (leather gloves, long sl re posted speed limits/ Wear seat	ed transport cted path to work area/follow elothing) eeves, Langan approved safety belts at all times
27.Traffic 1. Hit by moving vehicle		 Use tra Caution 	ffic cones and signage/ Use High n tape when working near active ro	visibility traffic vests and clothing/ badways.		
28. Field Work (drilling, restection)	 Field Work (drilling, resistivity and inspection) 1. Biological Hazards: insects, rats, snakes, poisonous plants, and other animals 7. Heat stress/injuries 8. Cold Stress/injuries 9. High Energy Transmission Lines 10. Underground Utilities 11. Electrical (soil resistivity testing) 		56. Inspect sleeve tall gra leaving contac 57. Wear p breaks 58. Wear p 59. Avoid c equipm transm	work area to identify biological has shirt and long pants/ Use insect re ss, bushes, woods and other area garbage on site to prevent attract with poisonous plants/Beware of roper clothing (light colored)/ drink (use sun block roper clothing/ dress in layers/ tak irect contact with high energy tran tent at least 15 feet or as required ission lines/ wear proper PPE (die	zards. Wear light colored long epellant as necessary/ Beware of s where ticks may live/ Avoid ting animals/ Identify and avoid rats, snakes, or stray animals. c plenty of water/ take regular e regular breaks. Ismission lines/ position by PSE&G from the lectric overshoes 15 kV	

minimum rating).

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
29 All activities	41 Slins/Trins/Falls	 60. Call one-call service before performing intrusive field work/ Review utility mark-outs and available utility drawings (with respect to proposed work locations)/ Follow Underground Utility Guidelines 61. See AGI Sting R1 operating manual for specific concerns during operating instrument 62. Be aware of potential trip bazards / Follow good bousekeeping
29. All activities	 41. Slips/ Fills 42. Hand injuries, cuts or lacerations during manual handling of materials 43. Foot injuries 44. Back injuries 45. Traffic 46. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 47. High Noise levels 48. Overhead hazards 49. Heat Stress/ Cold Stress 50. Eye Injuries 	 62. Be aware of potential nip flazards / Polick good housekeeping procedures/ Mark significant hazards 63. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 64. Wear Langan approved safety shoes 65. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 66. Wear high visibility clothing & vest / Use cones or signs to designate work area 67. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 68. Wear proper hearing protection 69. Wear hard hat / Avoid areas were overhead hazards exist. 70. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 71. Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date						
Prepared by:	Prepared by:							
Reviewed by:								

JSA Title: Site Inspection JSA Number: JSA024-01

A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the preventative/corrective actions required to reduce/mitigate the identified potential hazards. Employees must certify that they have either prepared the JSA or have reviewed the JSA and are aware of the potential hazards associated with this task and will follow the provided preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Last Minute Risk Assessment.





PERSONAL PROTECTIVE EQUIPMENT (Required or to be worn as needed):						
Safety Shoes	☑ Long Sleeves	Safety Vest (Cla	ass 2)	Hard Hat	Hearing Protection	
Safety Glasses	Safety Goggles	Face Shield		☑ Nitrile Gloves	PVC Gloves	
Leather Gloves	Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots	
Insect/Animal Repellent	Ivy Blocker/Cleaner	☐ Traffic Cones/Signs		Life Vest/Jacket		
□ Other:						
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORREC	CTIVE ACTION	
30.Jobsite Pre-briefing	23.None		 Review JSA, SOP's, and discuss hazards that may be present and control measures for present hazards while on-site. 		zards that may be present and e on-site.	

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
2. Working near railroads	 Passing Trains. Slip/Trips/Falls. 	 Wear reflective vest/ Stay away from tracks/ Do not cross tracks within 10 ft. of train car or when there is a train within view/listen for train horn. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
3. Walking around site	 Uneven terrain Wildlife: Stray animals, mice/rats, vectors (i.e. mosquitoes, bees, etc.) Weather: Heat/cold stress Slip/Trips/Falls Foot injuries Eye injuries 	 Pay attention to surrounding area (puddles, wet, frozen, uneven areas); Mark with cones or spray paint. Use bug spray/ Avoid stray animals/Use repellant when needed. Dress for the correct weather situation/ Use sunscreen or protective clothing in sunlight, layers in cold weather/ Drink plenty of fluids/ Take breaks when needed. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones. Wear proper PPE (Langan approved safety shoes)/ Change wet socks during cold weather. Wear proper PPE (safety glasses/goggles).
4. Working near road	 Passing vehicles Slip/Trips/Falls 	 Wear reflective vest/ Stay away from roadway/ Use buddy system/ Place signage or cones when needed. Be aware of tripping hazards/ Follow good housekeeping procedures/ Mark significant hazards with spray paint or cones.
5. All activities	 Slips/ Trips/ Falls Hand injuries, cuts or lacerations during manual handling of materials Foot injuries Back injuries Traffic Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) High Noise levels Overhead hazards Heat Stress/ Cold Stress Eye Injuries 	 72. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 73. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 74. Wear Langan approved safety shoes 75. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 76. Wear high visibility clothing & vest / Use cones or signs to designate work area 77. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 78. Wear hearing protection 79. Wear hard hat / Avoid areas were overhead hazards exist. 80. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 81. Wear safety glasses
Additional items.		

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

	LANGAN	1		Job Safety Health	Analysis (JSA) and Safety
JSA Title: Geotechnical JSA Number: JSA014-01	Drilling			ST	<u>S</u> – Stop, what has changed?
A Job Safety Analysis (JSA) must identify all job steps required to complete the task, potential hazards employees could be exposed to while performing the job step and		e task, the ep and the		$\frac{1}{P} = F_{valuate} \text{ potential hazards}$	
preventative/corrective action Employees must certify that th	s required to reduce/mitigate th ey have either prepared the JSA	e identified potenti or have reviewed t	al hazards. he JSA and	TAKE 5	<u>P</u> – Plan safe approach
are aware of the potential ha preventive/corrective actions. Minute Risk Assessment.	zards associated with this tash Prior to the start of any work	c and will follow th "TAKE 5" and cond "TAKE 5" and cond "TAKE 5" and cond"	e provided duct a Last		<u>S</u> - Start task / Stop & regroup
PERSONAL PROTECTIVE EQU	JIPMENT (Required or to be wor	n as needed):			
Safety Shoes	☑ Long Sleeves	Safety Vest (Cla	ass 2)	🛛 Hard Hat	Hearing Protection
Safety Glasses	Safety Goggles	Face Shield		☑ Nitrile Gloves	PVC Gloves
☑ Leather Gloves	Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	Traffic Cones/S	igns	Life Vest/Jacket	
Other: NomeX (as needed)			-		
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORR	ECTIVE ACTION
31.Transport equipment to	24.Back Strain		6. Use pr	oper lifting techniques / Use whe	eeled transport
					······································
work area	25.Slips/ Trips/ Falls 26 Traffic		7. Minimiz Follow	ze distance to work area / Have	unobstructed path to work area /
work area	25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipme	ent	7. Minimi Follow 8. Wear p	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of	unobstructed path to work area / r clothing)
work area	25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipme 28.Contusions from dropped equ	ent uipment	 7. Minimit Follow 8. Wear p 9. Wear p 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long	unobstructed path to work area / r clothing) sleeves)
work area	25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipme 28.Contusions from dropped equ	ent uipment	 Minimit Follow Wear p Wear p Wear p Wear p 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes)	unobstructed path to work area / r clothing) sleeves)
work area 32. Set-up HSA/SPT rig	25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipme 28.Contusions from dropped equ 6. Slips/ Trips/ Falls 7. Pinch Hazards	ent uipment	 Minimi, Follow Wear p Wear p Wear p Wear p Be awa proceed 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol lures / Mark significant below-gra	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches)
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 	ent uipment	 Minimi, Follow Wear p Wear p Wear p Wear p Wear p Be away proced with sa 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches)
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 	ent uipment	 Minimi, Follow Wear p Wear p Wear p Wear p Be awa proced with sa Wear p 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol lures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves)	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches)
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 	ent uipment nt and debris from	 Minimi, Follow Wear p Wear p Wear p Wear p Be awa proced with sa Wear p Wear p Wear p Wear p Wear p 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection)	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches)
work area 32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 	ent uipment nt and debris from	 Minimi, Follow Wearp Wearp Wearp Wearp Wearp Be away proced with sa Wearp 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection) proper attire for HSA/SPT rig (no proper PPE (hard hats) / Be awa	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) - loose clothing, strings, etc.) re of locations at all times / Look
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 12.HSA/SPT rig roll-over 	ent uipment nt and debris from	 Minimi, Follow Wear p Wear p Wear p Wear p Be awa proced with sa Wear p 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection) proper attire for HSA/SPT rig (no proper PPE (hard hats) / Be awa wn and around before raising ma	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) e loose clothing, strings, etc.) re of locations at all times / Look ast / Check HSA/SPT drill rig mast
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 12.HSA/SPT rig roll-over 13.HSA/SPT rig movement 	ent uipment nt and debris from	 Minimi, Follow Wear p Wear p Wear p Wear p Wear p Be awa proced with sa Wear p Stead 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection) proper PPE (hearing protection) proper PPE (hard hats) / Be awa wn and around before raising ma se objects/debris before raising	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) e loose clothing, strings, etc.) re of locations at all times / Look ast / Check HSA/SPT drill rig mast
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 12.HSA/SPT rig roll-over 13.HSA/SPT rig movement 	ent uipment nt and debris from	 Minimi, Follow Wear p Wear p Wear p Wear p Wear p Be awa proced with sa Wear p Stand Do pot 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection) proper PPE (hearing protection) proper PPE (hard hats) / Be awa wn and around before raising ma se objects/debris before raising upwind of rig engine ; move rig with mast raised / Set	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) - loose clothing, strings, etc.) re of locations at all times / Look ast / Check HSA/SPT drill rig mast stabilizers prior to raising mast /
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 12.HSA/SPT rig roll-over 13.HSA/SPT rig movement 	ent uipment nt and debris from	 Minimi, Follow Wear p Wear p Wear p Wear p Wear p Be away proced with sa Wear p Stand Do not Inspec 	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (hearing protection) proper PPE (hearing protection) proper PPE (hard hats) / Be awa wn and around before raising ma se objects/debris before raising upwind of rig engine to work area / If area appears uns	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) cloose clothing, strings, etc.) re of locations at all times / Look ast / Check HSA/SPT drill rig mast stabilizers prior to raising mast / stable, the boring locations should
32. Set-up HSA/SPT rig	 25.Slips/ Trips/ Falls 26.Traffic 27.Cuts/abrasions from equipmed 28.Contusions from dropped equipmed 6. Slips/ Trips/ Falls 7. Pinch Hazards 8. High noise levels 9. Clothing entanglement 10.Electrocution/falling equipmed raising HSA/SPT rig mast 11.Carbon monoxide poisoning 12.HSA/SPT rig roll-over 13.HSA/SPT rig movement 	ent uipment nt and debris from	 Minimi, Follow Wearp Wearp Wearp Wearp Wearp Wearp Be away proced with sa Wearp Nearp Wearp Nearp Near	ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (leather gloves) are of potential trip hazards / Fol dures / Mark significant below-gra afety cones or spray paint proper PPE (leather gloves) proper PPE (leather gloves) proper PPE (hearing protection) proper Attire for HSA/SPT rig (no proper PPE (hard hats) / Be awa wn and around before raising ma se objects/debris before raising upwind of rig engine move rig with mast raised / Set at work area / If area appears unside ved.	unobstructed path to work area / r clothing) sleeves) low good housekeeping ade hazards (i.e. holes, trenches) - loose clothing, strings, etc.) re of locations at all times / Look ast / Check HSA/SPT drill rig mast stabilizers prior to raising mast / stable, the boring locations should rig while moving / Use a spotter

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
 33. Advance HSA/SPT rods, augers and casing below ground surface 34. Advance HSA/SPT rods, augers and casing below ground surface (cont'd) 	 8. Strain wrist/bruise palm 9. Pinched fingers 10. Back strain 11. Clothing entanglement 12. Carbon monoxide poisoning 13. Bruised/Broken toes/feet 14. High noise levels 	 Wear proper PPE (leather gloves) / Use proper technique for preparing rods / Use second person, if necessary Wear proper PPE (leather gloves) Use proper lifting techniques / Obtain assistance if needed Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) Stand upwind of the rig Wear proper PPE (safety shoes) Wear proper PPE (hearing protection)
35.Remove and open split spoon	 8. Pinched fingers 9. Cuts/lacerations 10. Skin contact with contaminated soil and groundwater 	 Wear proper PPE (nitrile and leather gloves) Wear proper PPE (leather gloves) Wear proper PPE (nitrile gloves, safety glasses)
36.Repeat steps 3 and 4 until desired depth is reached	1. See steps 3 and 4	1. See steps 3 and 4
37.Remove HSA/SPT rods, augers and casing and place in storage rack	 Clothing entanglement Back strain Pinched fingers Carbon monoxide poisoning High noise levels 	 Wear proper attire for HSA/SPT rig (no loose clothing, strings, etc.) Use proper lifting techniques / Obtain assistance if needed Wear proper PPE (leather gloves) Stand upwind of rig engine Wear proper PPE (hearing protection)
 Tremie-grout borehole with a cement-bentonite grout mixture 	 Splash cement/bentonite grout on face/eyes Back strain Pinched fingers 	 Wear proper PPE (safety glasses) Use proper lifting techniques / Obtain assistance if needed Wear proper PPE (nitrile gloves, leather gloves)
39. Decontaminate equipment	 Contact with potentially impacted material Contact with sharp pieces of equipment 	 Wear proper PPE (safety glasses, nitrile gloves) Wear proper PPE (leather gloves)
40. Patch soil boring location to return to pre-existing conditions (i.e. concrete, asphalt, grass)	 Cuts/lacerations Splashed concrete on face/eyes Hammer fingers/hands when patching asphalt 	 Wear proper PPE (leather gloves) / Use scissors for cutting Use proper PPE (safety glasses) Be aware of hands/fingers during hammering / Wear proper PPE (leather gloves)
41. All activities	 61. Slips/ Trips/ Falls 62. Hand injuries, cuts or lacerations during manual handling of materials 63. Foot injuries 64. Back injuries 65. Traffic 66. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 67. High Noise levels 68. Overhead hazards 69. Heat Stress/ Cold Stress 70. Eye Injuries 	 82. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 83. Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 84. Wear Langan approved safety shoes 85. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 86. Wear high visibility clothing & vest / Use cones or signs to designate work area 87. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 88. Wear hearing protection

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
		 89. Wear hard hat / Avoid areas were overhead hazards exist. 90. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 91. Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
<u>Reviewed by:</u>		

	LANGAN			Job Safety Health	Analysis (JSA) and Safety
JSA Title: General Const JSA Number: JSA010-01	ruction Activities			s T	<u>S</u> – Stop, what has changed?
A Job Safety Analysis (JSA) potential hazards employees preventative/corrective action Employees must certify that th are aware of the potential ha preventive/corrective actions. Minute Risk Assessment.	must identify all job steps requ could be exposed to while pe s required to reduce/mitigate th ey have either prepared the JSA zards associated with this task Prior to the start of any work	lired to complete the rforming the job stone identified potenti A or have reviewed the k and will follow the "TAKE 5" and control	e task, the ep and the al hazards. he JSA and e provided duct a Last	TAKE 5	$\underline{\Gamma} - Think about the task$ $\underline{P} = Evaluate potential hazards$ $\underline{P} - Plan \text{ safe approach}$ $\underline{S} - Start task / Stop & regroup$
PERSONAL PROTECTIVE FOR	IIPMENT (Pequired or to be wo	rn as needed):			
Safety Shoes		Safety Vest (Cla	2000 2)	M Hard Hat	M Hearing Protection
Safety Glasses		Eace Shield	(55 2)		
			iano		
		M Traine Cones/S	igns		
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORR	ECTIVE ACTION
42.Transport equipment to work area	29.Back Strain 30.Slips/ Trips/ Falls 31.Traffic 32.Cuts/abrasions from equipme 33.Contusions from dropped eq	ent uipment	11. Use pr 12. Minimi Follow 13. Wear p 14. Wear p 15. Wear p	oper lifting techniques / Use whe ze distance to work area / Have good housekeeping procedures proper PPE (high visibility vest of proper PPE (leather gloves, long proper PPE (safety shoes)	eeled transport unobstructed path to work area / r clothing) sleeves)
43.Installation of piping from vapor wells to skid connections and fro discharge pipping to effluent stack	14. Pinch fingers when connecti 15.Slips/ Trips/ Falls 16.Machinery Hazards	ing pipes	12. Wear 13. Be awa proced with sa 14. Wear p machir	proper PPE (leather gloves) are of potential trip hazards / Pra lures / Mark significant below-gra ifety cones or spray paint proper PPE (safety vest) / Mainta nery	actice good housekeeping ade hazards (i.e. holes, trenches) ain safe distance from operating
44.Remediation equipment installation	 15. Back strain when lifting 16. Slips/ Trips/ Falls 17. Traffic 	g heavy equipment	11. Use pr to vehi 12. Be awa proced with sa 13. Wear p	oper lifting techniques / Use whe cle are of potential trip hazards / Pra lures / Mark significant below-gra ifety cones or spray pain proper PPE (safety vest)	eeled transport / Minimize distance actice good housekeeping ade hazards (i.e. holes, trenches)
45. All activities	 71. Slips/ Trips/ Falls 72. Hand injuries, cuts or lacera manual handling of materia 73. Foot injuries 74. Back injuries 	ations during Is	92. Be awa proced 93. Inspect fingers objects	re of potential trip hazards / Follo lures/ Mark significant hazards for jagged/sharp edges, and rou away from pinch points / Wipe o before handling / Wear leather/	ow good housekeeping igh or slippery surfaces / Keep off greasy, wet, slippery or dirty / cut-resistant gloves

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
4. All activities (cont'd) Additional items.	 75. Traffic 76. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 77. High Noise levels 78. Overhead hazards 79. Heat Stress/ Cold Stress 80. Eye Injuries 	 94. Wear Langan approved safety shoes 95. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 96. Wear high visibility clothing & vest / Use cones or signs to designate work area 97. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 98. Wear hearing protection 99. Wear hard hat / Avoid areas were overhead hazards exist. 100. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 101. Wear safety glasses
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
Reviewed by:		

	LANGAN			Job Safety Health	Analysis (JSA) and Safety
JSA Title: Field Samplin JSA Number: JSA022-01	g			S	<u>S</u> – Stop, what has changed?
A Job Safety Analysis (JSA)	must identify all job steps requ	ired to complete th	e task, the		$\underline{\mathbf{I}} - \mathbf{I} \mathbf{n} \mathbf{n} \mathbf{k} \text{ about the task}$
preventative/corrective action	is required to reduce/mitigate th	ne identified potenti	al hazards.	TAKE 5	\underline{P} \underline{E} – Evaluate potential hazards
Employees must certify that the	ney have either prepared the JSA	or have reviewed the and will follow the	he JSA and	TAKE 5	S <u>P</u> – Plan safe approach
preventive/corrective actions.	Prior to the start of any work	"TAKE 5" and cond	duct a Last		<u>S</u> - Start task / Stop & regroup
Minute Nisk Assessment.					
PERSONAL PROTECTIVE EQ	UIPMENT (Required or to be wor	rn as needed):	0)		
Safety Shoes	☑ Long Sleeves	Safety Vest (Cla	ass 2)	Hard Hat	Hearing Protection
Safety Glasses	Safety Goggles	Face Shield		☑ Nitrile Gloves	PVC Gloves
Leather Gloves	Cut Resist. Gloves	☐ Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	Ivy Blocker/Cleaner	☑ Traffic Cones/S	igns	Life Vest/Jacket	
Other:					
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORI	RECTIVE ACTION
JOB STEPS 46.Unpack/Transport	POTENTIAL HAZ 34.Back Strains	ARDS	24. Us	PREVENTATIVE / CORI	wheeled transport
JOB STEPS 46.Unpack/Transport equipment to work area.	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls	ARDS	24. Us 25. Mi	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U	RECTIVE ACTION wheeled transport nobstructed path to work
JOB STEPS 46.Unpack/Transport equipment to work area.	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped equipmed	ARDS ent	24. Us 25. Mi area/follo	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with
JOB STEPS 46.Unpack/Transport equipment to work area.	POTENTIAL HAZ34.Back Strains35.Slip/Trips/Falls36.Cuts/Abrasions from equipmed37.Contusions from dropped equipmed	ARDS ent uipment	24. Us 25. Mi area/folk orange s 26. W	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. ear proper PPE (leather gloves	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with
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JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped equipmed 17.Traffic	ARDS ent uipment	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. lear proper PPE (leather gloves lear proper PPE (Langan appro nal awareness (be alert of your s	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipm 37.Contusions from dropped eq 17.Traffic	ARDS ent uipment	24. Us 25. Mi area/folk orange s 26. W 27. W 7. Situation through	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. 'ear proper PPE (leather gloves 'ear proper PPE (Langan appro nal awareness (be alert of your s traffic.	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or	ARDS ent uipment Skin/eye contact	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. ear proper PPE (leather gloves ear proper PPE (Langan appro nal awareness (be alert of your s traffic. propriate PPE (Safety glasses, amicals being	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49 Sampling from bridges	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or 11 Struck by vehicles	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. lear proper PPE (leather gloves lear proper PPE (Langan appro nal awareness (be alert of your s traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest) Us	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or 11. Struck by vehicles	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones.	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. lear proper PPE (leather gloves lear proper PPE (Langan appro nal awareness (be alert of your s traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Us	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed and a strain and the strain and th	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain of	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. /ear proper PPE (leather gloves /ear proper PPE (Langan appro nal awareness (be alert of your st traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Us coolers of water. Use proper lifti	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ing techniques. Use wheeled
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/ Transporting	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or 11. Struck by vehicles 81. Back Strains 82. Slips/Trips/Falls	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/folk orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain o transpo	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. 'ear proper PPE (leather gloves 'ear proper PPE (Langan appro nal awareness (be alert of your s traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Us coolers of water. Use proper liftiont.	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ng techniques. Use wheeled
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/ Transporting coolers/equipment from	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or 11. Struck by vehicles 81. Back Strains 82. Slips/Trips/Falls 83. Cuts/Abrasions from equipmed equi	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain o transpo 103.Have u	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. ear proper PPE (leather gloves ear proper PPE (Langan appro- nal awareness (be alert of your s traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Us coolers of water. Use proper liftiont. unobstructed path from work are	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ing techniques. Use wheeled ea. Aware of surroundings.
JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/ Transporting coolers/equipment from work area.	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed 37.Contusions from dropped eq 17.Traffic 18. Contaminated media. S with biological agents and/or 11. Struck by vehicles 81. Back Strains 82. Slips/Trips/Falls 83. Cuts/Abrasions from equipmed eq 81. Back Strains 84. Pinch/Crushing Hazards. 84. Pinch/Crushing Hazards.	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain of transpo 103.Have u 104.Wear p	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. lear proper PPE (leather gloves lear proper PPE (Langan appro- nal awareness (be alert of your st traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Use coolers of water. Use proper liftiont. unobstructed path from work are proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ing techniques. Use wheeled ea. Aware of surroundings. hg sleeves) og sleeves)
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JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/ Transporting coolers/equipment from work area. 51. Site Departure 52. All activities	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed and a strains 37.Contusions from dropped equipmed and a strains 17.Traffic 18. Contaminated media. Strains with biological agents and/or 11. Struck by vehicles 81. Back Strains 82. Slips/Trips/Falls 83. Cuts/Abrasions from equipmed agents 84. Pinch/Crushing Hazards. 1. Contaminated PPE/Vehicle 1. Slips/Trips/Falls	ARDS ent uipment Skin/eye contact chemicals.	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain of transpo 103.Have u 104.Wear p 105.Wear p 105.Wear p 1. Contami clothing for	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. /ear proper PPE (leather gloves /ear proper PPE (Langan appro- nal awareness (be alert of your st traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Use coolers of water. Use proper liftiont. unobstructed path from work are proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor proper PPE should be disposed secure storage in trunk. Wash re of potential trip hazards / Foll	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ing techniques. Use wheeled ea. Aware of surroundings. ng sleeves) of on-site. Remove boots and soiled hands promptly. ow good housekeeping procedures/
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JOB STEPS 46.Unpack/Transport equipment to work area. 47.Initial Site Arrival-Site Assessment 48.Surface Water Sampling 49.Sampling from bridges 50. Icing of Samples/ Transporting coolers/equipment from work area. 51. Site Departure 52. All activities	POTENTIAL HAZ 34.Back Strains 35.Slip/Trips/Falls 36.Cuts/Abrasions from equipmed and a strains 36.Cuts/Abrasions from dropped equipmed and a strains 17.Traffic 18. Contaminated media. Strains 18. Contaminated media. Struck by vehicles 81. Back Strains 82. Slips/Trips/Falls 83. Cuts/Abrasions from equipmed and a structure for the structure of th	ARDS ent uipment Skin/eye contact chemicals. nent tions during manual	24. Us 25. Mi area/follo orange s 26. W 27. W 7. Situation through 7. Wear ap for all ch 5. Wear ap cones. 102.Drain of transpo 103.Have u 104.Wear p 105.Wear p 105.Wear p 1. Contami clothing for 1. Be awar Mark signif 2. Inspect	PREVENTATIVE / CORI se proper lifting techniques/Use inimize distance to work area/U ow good housekeeping procedu safety cones. ear proper PPE (leather gloves ear proper PPE (Langan appro- nal awareness (be alert of your st traffic. propriate PPE (Safety glasses, emicals being. propriate PPE (Safety Vest). Use coolers of water. Use proper lifti ort. unobstructed path from work are proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor proper PPE (Leather gloves, lor proper PPE should be disposed secure storage in trunk. Wash re of potential trip hazards / Foll icant hazards t for jagged/sharp edges, and	RECTIVE ACTION wheeled transport nobstructed path to work ures. Mark slip/trip/fall hazards with , long sleeves). ved safety shoes). surroundings). Secure area from appropriate gloves). Review MSDS se buddy system and orange safety ing techniques. Use wheeled ea. Aware of surroundings. ng sleeves) of on-site. Remove boots and soiled hands promptly. ow good housekeeping procedures/ rough or slippery surfaces / Keep

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	 handling of materials 3. Foot injuries 4. Back injuries 85. Traffic 86. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 87. High Noise levels 88. Overhead hazards 89. Heat Stress/ Cold Stress 90. Eye Injuries 	 before handling / Wear leather/ cut-resistant gloves 3. Wear Langan approved safety shoes 4. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 106. Wear high visibility clothing & vest / Use cones or signs to designate work area 107. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 108. Wear hearing protection 109. Wear hard hat / Avoid areas were overhead hazards exist. 110. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 111. Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date
Prepared by:		
<u>Reviewed by:</u>		

LANGAN JSA Title: Excavation Oversight JSA Number: JSA041-01 A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the			Job Safety Analysis (JSA) Health and Safety S – Stop, what has changed? <u>I</u> – Think about the task <u>E</u> – Evaluate potential hazards			
preventative/corrective actions required to reduce/mitigate the identified potential haz Employees must certify that they have either prepared the JSA or have reviewed the JSA are aware of the potential hazards associated with this task and will follow the pro- preventive/corrective actions. Prior to the start of any work "TAKE 5" and conduct a Minute Risk Assessment.			he JSA and e provided duct a Last	TAKE 5	S <u>P</u> – Plan safe approach <u>S</u> - Start task / Stop & regroup	
PERSONAL PROTECTIVE FO	UIPMENT (Required or to be wa	rn as needed):				
Safety Shoes	☐ Long Sleeves	Safety Vest (Cla	ass 2)	Hard Hat	Hearing Protection	
Safety Glasses	□ Safety Goggles	☐ Face Shield	,	☐ Nitrile Gloves	□ PVC Gloves	
☐ Leather Gloves	☐ Cut Resist. Gloves	☐ Fall Protection		☐ Fire Resistant Clothing	Rubber Boots	
Insect/Animal Repellent	☐ Ivv Blocker/Cleaner	☐ Traffic Cones/S	ians	Life Vest/Jacket		
□ Other:						
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / COR	RECTIVE ACTION	
53. Transport equipment to work area	 38. Back Strain 39. Slips/Trips/Falls 40. Traffic 41. Cuts/abrasions/contusions from equipment 		28. Us 29. Mi ar 30. W 31. W	 Use proper lifting techniques / Use wheeled transport Minimize distance to work area / Have unobstructed path to work area / Follow good housekeeping procedures Wear proper PPE (high visibility vest or clothing) Wear proper PPE (leather gloves, long sleeves, safety shoes) 		
54.Earth Moving Equipment	18. Equipment running over employee8.9.		8. Ensure y behind e 9. Wear pro	Ensure you have direct line of sight with operator of equipment; don't walk behind equipment; maintain a safe distance away from equipment. Wear proper PPE (high vis vest/clothing)		
55.Excavation	19.Excavation collapse8.Use20.Confined spacesitu21.Soilins9.Lar10.Soil		 Use pr situate inspec Langar Soil an 	 proper shoring/benching/sloping techniques; Ladder is properly lated in excavation; no water in excavation; competent person has bected excavation prior to allow employees to enter. I and equipment is kept at least 2 feet from edge of excavation 		
56.Excavated soil	1. Hazardous substances		1. Use pro levels do no	per equipment to monitor exca ot exceed PEL's for contaminat	avated soil for contaminates; ensure tes; Wear proper PPE	
57. All activities	91. Slips/ Trips/ Falls11292. Hand injuries, cuts or lacerations during manual handling of materials11393. Foot injuries1494. Back injuries114		112.Be awa proced 113.Inspec fingers objects 114.Wear p	 12.Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards 13.Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves 14.Wear proper PPE (Langan approved safety shoes) 		

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	 96. Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) 97. High Noise levels 98. Overhead hazards 99. Heat Stress/ Cold Stress 100.Eye Injuries 	 115. Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible 116. Wear high visibility clothing & vest / Use cones or signs to designate work area 117. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 118. Wear hearing protection 119. Wear hard hat / Avoid areas were overhead hazards exist. 120. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 121. Wear safety glasses
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date		
Prepared by:				
<u>Reviewed by:</u>				

LANGAN JSA Title: Equipment Transportation and Set-up JSA Number: JSA012-01 A Job Safety Analysis (JSA) must identify all job steps required to complete the task, the potential hazards employees could be exposed to while performing the job step and the			Job Safety Analysis (JSA) Health and Safety <u>S</u> – Stop, what has changed? <u>T</u> – Think about the task E – Evaluate potential bazards		
preventative/corrective action Employees must certify that the are aware of the potential has preventive/corrective actions. Minute Risk Assessment.	is required to reduce/mitigate the ney have either prepared the JSA azards associated with this tas Prior to the start of any work	ne identified potenti A or have reviewed to k and will follow th "TAKE 5" and cond	al hazards. he JSA and he provided duct a Last	TAKE 5	S <u>P</u> – Plan safe approach <u>S</u> - Start task / Stop & regroup
Safety Shoes	UIPMENT (Required or to be wo	rn as needed):	ass 2)	⊠ Hard Hat	Hearing Protection
Safety Glasses	Safety Goggles	☐ Face Shield	200 2)	☐ Nitrile Gloves	
Leather Gloves	Cut Resist. Gloves	Fall Protection		Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	☐ Ivy Blocker/Cleaner	Traffic Cones/Signs		☐ Life Vest/Jacket	
Other:					
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORRECTIVE ACTION	
58. I ransport equipment to	42.Back Strain 43 Slips/ Trips/ Falls		16. Use pr	roper lifting techniques / Use wheeled transport ize distance to work area / Have unobstructed path to work area /	
work area	44.Traffic		Follow	good housekeeping procedure	s
	45.Cuts/abrasions from equipm	ent	18. Wear p	proper PPE (high visibility vest of	or clothing)
	46.Contusions from dropped eq	uipment	19. Wear p	proper PPE (leather gloves, long	g sleeves)
59.Moving equipment to its	19.Pinch Hazard 15. Wea		15. Wear p	proper PPE (leather gloves)	
planned location	20.Slips/ Trips/ Falls		16. Be awa	are of potential trip hazards / Pr	actice good housekeeping
			proced	lures / Mark significant below-gi	rade hazards (i.e. holes, trenches)
60.Equipment Set-up	22. Pinch Hazard		14. Wear p	proper PPE (leather gloves)	
	23. Cuts/abrasions to knuc	kles/hands	15. Wear p	proper PPE (leather gloves)	
	24. Back Strain		16. Use pr	oper lifting techniques / Use wh	eeled transport
61. All activities	102. Hand injuries, cuts or lacera	ations during	Droced	are of potential trip nazards / Fo	niow good nousekeeping
	manual handling of materia	ls	123.Inspec	t for jagged/sharp edges, and re	ough or slippery surfaces / Keep
	103.Foot injuries		fingers	away from pinch points / Wipe	off greasy, wet, slippery or dirty
	104.Back injuries		Objects	before handling / Wear leather	/ cut-resistant gloves
	106.Wildlife: Stray dogs, Mice/ra	ats, Vectors (i.e.	125.Use pr	oper lifting techniques / Conside	er load location, task repetition, and
	mosquitoes, bees, etc.)	· ·	load w	eigh when evaluating what is sa	afe or unsafe to lift / Obtain
	107.High Noise levels		assista	ince when possible	

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
	109.Heat Stress/ Cold Stress 110.Eye Injuries	 126. Wear high visibility clothing & vest / Use cones or signs to designate work area 127. Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed 128. Wear hearing protection 129. Wear hard hat / Avoid areas were overhead hazards exist. 130. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress 131. Wear safety glasses
17. All activities (cont'd)		
Additional items.		
Additional Items identified while in the field.		
(Delete row if not needed.)		

Print Name	<u>Sign Name</u>	Date			
Prepared by:					
Reviewed by:					
LANGAN			Job Safety A Health a	nalysis (JSA) nd Safety	
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JSA Title: Environmental JSA Number: JSA021-01	l Sampling			s T -	<u>S</u> – Stop, what has changed?
A Job Safety Analysis (JSA) potential hazards employees	must identify all job steps requ could be exposed to while pe	ired to complete th	e task, the ep and the		<u>T</u> – Think about the task P E – Evaluate potential bazards
preventative/corrective action Employees must certify that th	s required to reduce/mitigate the sequired to reduce/mitigate the set her prepared the JSA	ne identified potenti or have reviewed the	al hazards. he JSA and	TAKE 5	<u>P</u> – <i>Plan</i> safe approach
are aware of the potential ha preventive/corrective actions. Minute Risk Assessment.	zards associated with this tas Prior to the start of any work	k and will follow th "TAKE 5" and cond	e provided duct a Last		<u>S</u> - Start task / Stop & regroup
PERSONAL PROTECTIVE EQU	JIPMENT (Required or to be wol	rn as needed):	200 2)		
Salety Shoes		Salety Vest (Cla	ass Z)		
				Fire Resistant Clothing	Rubber Boots
Insect/Animal Repellent	V Ivy Blocker/Cleaner	Traffic Cones/S	igns	Life Vest/Jacket	
Other: Tyvek Sleeves					
JOB STEPS	POTENTIAL HAZ	ARDS		PREVENTATIVE / CORRE	CTIVE ACTION
62. Drive to sample location	47. Rough/Off Road terrain		1. Pay a embankme	ttention to road conditions such nts, and soft road conditions.	h as road erosion, unprotected
63. Sample Collection (Walking)	 21. Slip/Trips/Falls 22. Back strains 23. Wildlife (Insects, Stray anin 24. Poisonous vegetation 	nals, rodents)	 Minimi: carryin housel trenche suppor Use pr where safe ar Be awa stray a spray v Keep s after co 	ze distance to sample area/ Plan g heavy equipment/ Locate safest keeping procedures/ Mark significa es) with spray paint or cones/ Wea t and gripping soles. oper lifting techniques/ Use wheel and when needed/ Consider load nd unsafe to carry. are of surroundings for the presen nimals/ Carry and use animal repo- when needed. skin covered/ Identify and avoid po- pontact with suspected vegetation.	route and check surface prior to t access point/ Follow good ant below grade hazards (holes, ar foot protection with ankle led transport/ Obtain assistance weight when evaluating what is acc of wildlife/ Do not approach ellant when needed/ Use bug bisonous vegetation/ Clean areas
64. Sample Collection (Water)	 Drowning Hazards Chemical burns (when addi preservative to sample) Back Strains Ergonomic issues Slip/Trips/Falls 	ng acid	 Use bu swift m cross of Wear p Use pr where safe or 	iddy system/ Wear flotation vest if noving/ Select working area with si or stand in swift moving water. oroper PPE (Nitrile gloves, Tyvek i oper lifting techniques/ Use wheel and when needed/ Consider load runsafe to carry.	water is deeper than 2 feet or table footing/ Do not attempt to Sleeves) led transport/ Obtain assistance weight when evaluating what is

JOB STEPS	POTENTIAL HAZARDS	PREVENTATIVE / CORRECTIVE ACTION
65. All activities	 Slips/Trips/Falls Hand injuries, cuts or lacerations during manual handling of materials Foot injuries Back injuries Traffic Wildlife: Stray dogs, Mice/rats, Vectors (i.e. mosquitoes, bees, etc.) High Noise levels Overhead hazards Heat Stress/ Cold Stress Eye Injuries 	 When possible avoid bending over for long periods of time/ Use a small stool for sitting or knee pad for kneeling. Minimize distance to sample area/ Plan route and check surface prior to carrying heavy equipment/ Locate safest access point/ Follow good housekeeping procedures/ Mark significant below grade hazards (holes, trenches) with spray paint or cones/ Wear foot protection with ankle support and gripping soles/ Avoid standing water or slippery terrain. Be aware of potential trip hazards / Follow good housekeeping procedures/ Mark significant hazards Inspect for jagged/sharp edges, and rough or slippery surfaces / Keep fingers away from pinch points / Wipe off greasy, wet, slippery or dirty objects before handling / Wear leather/ cut-resistant gloves Wear Langan approved safety shoes Use proper lifting techniques / Consider load location, task repetition, and load weigh when evaluating what is safe or unsafe to lift / Obtain assistance when possible Wear high visibility clothing & vest / Use cones or signs to designate work area Be aware of surroundings at all times, including the presence of wildlife/ Do not approach stray dogs / Carry/use dog/animal repellant / Use bug spray when needed Wear hard hat / Avoid areas were overhead hazards exist. Wear proper attire for weather conditions (sunscreen or protective clothing in sunlight, layers for cold weather) / Drink plenty of fluids to avoid dehydration / Takes breaks as necessary to avoid heat/cold stress Wear safety glasses
Additional Items identified while		
in the field.		
(Delete row if not needed.)		

Print Name	Sign Name	Date	
Prepared by:			
Reviewed by:			

ATTACHMENT H

TAILGATE SAFETY BRIEFING FORM

LANGAN TAILGATE SAFETY BRIEFING

Date:	Time:
Leader:	Location:
Work Task:	
SAFETY TOPICS	(provide some detail of discussion points)
Chemical Exposure Hazards and Contro	ol:
Physical Hazards and Control:	
Air Monitoring:	
PPE:	
Communications:	
Safe Work Practices:	
Emergency Response:	
Hospital/Medical Center Location:	
Phone Nos.:	
Other:	
FOR FOLLOW-UP	(the issues, responsibilities, due dates, etc.)

ATTENDEES

PRINT NAME	COMPANY	SIGNATURE

ATTACHMENT I

THE CITY OF NEW YORK EXECUTIVE ORDER No. 74

Langan employees and their direct hire contractors will comply with all provisions of the New York City Executive Order No. 74 as signed by the Mayor on July 31, 2021. Specifically, effective August 2, 2021

- Will don face masks while on-site at all times; and
- Provide proof upon demand of full vaccination status.

A copy of the New York City Executive Order No. 74 is provide on the following pages.

APPENDIX F Quality Assurance Project Plan

QUALITY ASSURANCE PROJECT PLAN

REGO PARK CENTER III 61-10 JUNCTION BOULEVARD AND 93-30 93RD STREET Rego Park, New York 11421

Prepared for:

Alexander's of Rego Park III, Inc. c/o Vornado Realty Trust 888 Seventh Avenue, 44th Floor New York, New York 10019

Prepared by:

Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, D.P.C. 21 Penn Plaza 360 West 31st Street, 8th Floor New York, New York 10001



May 27, 2022 Langan Project No. 170229023

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- Attachment A Per- and Poly-fluoroalkyl Substances Sampling Protocol
- Attachment B PFAS Standard Operating Procedure
- Attachment C Resumes
- Attachment D Sample Nomenclature

1.0 **PROJECT DESCRIPTION**

1.1 INTRODUCTION

This Quality Assurance Project Plan (QAPP) for the proposed remedial investigation (RI) was completed on behalf of the Alexander's of Rego Park III, Inc. (the Applicant) for Rego Park Center III ("the site") located at 61-10 Junction Boulevard and 93-30 93rd Avenue in the Rego Park neighborhood of Queens, New York. The Participant, selected Langan Engineering, Environmental, Surveying, Landscape Architecture and Geology, DPC (Langan) to complete the RI. The objective of the RI is to investigate and characterize the nature and extent of environmental impacts at the site and emanating from the site and to provide sufficient information to evaluate remedial alternatives, as required. Additional site information and data collected previously by Langan is provided in the Remedial Investigation Work Plan (RIWP).

This QAPP specifies analytical methods to be used to ensure that data from the proposed Remedial Investigation (RI) at the site are precise, accurate, representative, comparable, and complete.

1.2 **PROJECT OBJECTIVES**

The objective of the RI is to investigate and characterize the nature and extent of on-site and offsite environmental impacts associated with areas of concern (AOC). This QAPP addresses sampling and analytical methods that may be necessary in support of the RI. These objectives were established in order to meet standards that will protect public health and the environment for the site.

1.3 SCOPE OF WORK

The field investigation will include the tasks listed below to supplement the data and findings of previous investigations, and is described in detail in the RIWP. All RI work will be overseen by Langan. The proposed RI consists of the following:

- Completion of a geophysical survey;
- Advancement of soil borings to evaluate potential subsurface impacts from the identified areas of concerns and historical site uses;
- Installation of monitoring wells;
- Completion of a monitoring well survey;
- Installation of soil vapor points;
- Collection and chemical analysis of soil, groundwater, soil vapor, and ambient air samples;
- Implementation of a community air monitoring plan (CAMP); and
- A qualitative assessment of potential exposure pathways based on the investigation findings.

1.3.1 SUMMARY OF PROPOSED FIELD SAMPLING ACTIVITIES

Soil Boring Installation and Soil Sampling

A geophysical subcontractor will clear subsurface testing locations of potential subsurface utilities and to locate any underground storage tanks (USTs). The geophysical survey will be completed using a collection of geophysical instruments, including electromagnetic and utility line locator instruments and ground-penetrating radar (GPR). The results of the survey may require relocating subsurface testing locations.

Soil Boring Installation and Soil Sampling

An environmental drilling subcontractor will advance a total of 55 soil borings to further investigate the areas of concern. Twenty-eight soil borings (designated SB-1 through SB-28) will be advanced to a depth of about 20 feet bgs using direct-push drilling technology (Geoprobe[®]). A total of 35 delineation soil borings will be advanced between 5 and 13 feet bgs around borings that identified hazardous concentrations of lead. Langan field personnel will document the work, screen soil samples for environmental impacts, and collect environmental soil samples for laboratory analyses. Soil will be screened continuously to the boring termination depth for organic vapors with a photoionization detector (PID) equipped with a 10.6 electron volt (eV) bulb and for visual and olfactory evidence of environmental impacts (e.g., non-aqueous phase liquid [NAPL], staining, and/or odor). Soil will be visually classified for color, grain size, texture, and moisture content, and will be recorded in a field log. Non-disposable, down-hole drilling equipment and sampling apparatus will be decontaminated between locations with Alconox[®] and water. Up to two soil samples will be collected for laboratory analysis from each boring location. One sample will be collected from within the surficial historic fill layer, or, if encountered, from the interval exhibiting the greatest degree of observed impact (based on presence of staining, odor, and/or PID readings above background); and one from the groundwater interface, or, if observed impact is encountered, one from the interval immediately below observed impact. One delineation soil sample will be collected at the interval of identified hazardous lead in redrilled borings RA-7_B, RA-8_B, RA-9_B, RA-16 B, and P-67 B. One or two delineation soil samples will be collected at the interval above and below the interval of identified hazardous lead. Samples collected from the 10-foot step out borings will be placed on hold at the laboratory pending TCLP results from the 5-foot step out borings. 1,4-Dioxane analysis will be performed according to USEPA Method 8270 with a reporting limit of 0.1 milligram per kilogram (mg/kg). Per- and poly-fluoroalkyl substances (PFAS) analysis will be performed according to USEPA Method 537 Modified with a reporting limit of 1 microgram per kilogram (ug/kg).

PFAS analysis will include the following 21 PFAS compounds:

- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUdA)
- Perfluorododecanoic acid (PFDoA)
- Perfluorotridecanoic Acid (PRTrDA)
- Perfluorotetradecanoic acid (PFTA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorooctanesulfonic acid (PFOS)

- Perfluorodecanesulfonic Acid (PFDS)
- Perfluorobutanoic Acid (PFBA)
- Perfluoropentanoic Acid (PFPeA)
- Perfluoroheptane Sulfonic Acid (PFHpS)
- 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2 FTS)
- 1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2 FTS)
- Perfluorooctanesulfonamide (FOSA)
- N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
- N-ethyl perfluorooctanesulfonamidoacetic acid (EtFOSAA)

PFAS compounds have been identified in myriad personal care products, sampling materials and field supplies. To limit potential cross contamination field staff will employ the following measures:

- Appropriate personal protective equipment (PPE) will be donned as needed, including boot covers and polyvinyl chloride (PVC) rain coats
- Field staff will limit use of fragrances and other personal care products containing conditioning agents
- Dedicated sampling equipment (e.g. nitrile gloves) will be used for PFAS sampling
- PFAS soil samples will be stored in a dedicated PFAS cooler for onsite storage and transport to the laboratory.
- Blue ice and freezer packs will not be used to cool samples during storage onsite or shipment to the laboratory

Monitoring Well Installation and Groundwater Sampling

Ten of the proposed soil boring locations will be converted into groundwater monitoring wells. The proposed wells will be installed so that the well screen straddles the observed groundwater table. The wells will be constructed with 1- or 2-inch diameter, threaded, flush-joint, polyvinyl chloride (PVC) casing and 0.01-inch slot screens. Clean sand will be used to fill the annulus around the

screen up to approximately two feet above the top of the screened interval. A two-foot bentonite seal will be installed above the sand, and the borehole annulus will be grouted to the surface with bentonite/cement slurry. After installation, wells will be developed by surging either a weighted bailer or surge block across the well screen/casing to agitate and remove fines.

Before sampling, the headspace of each well will be monitored with a PID and the wells will be gauged and purged. Dedicated tubing will be used at each well, and the interface probe and any sampling apparatus will be decontaminated between locations with Alconox® and water.

One groundwater sample will be collected from each newly-installed well in general accordance with NYSDEC DER-10 and United States Environmental Protection Agency's (USEPA) *Low Flow Purging and Sampling Procedures for the Collection of Groundwater Samples from Monitoring Wells.* Groundwater samples will be collected about one week after new wells are installed. No groundwater samples will be collected from monitoring wells containing NAPL.

PFAS and 1,4-Dioxane will be sampled in accordance with the protocol outlined in Attachments A and B. 1,4-Dioxane analysis will be performed according to USEPA Method 8270 SIM with a reporting limit of 0.35 ug/L.PFAS analysis will include the following 21 PFAS compounds:

- Perfluorohexanoic acid (PFHxA)
- Perfluoroheptanoic acid (PFHpA)
- Perfluorooctanoic acid (PFOA)
- Perfluorononanoic acid (PFNA)
- Perfluorodecanoic acid (PFDA)
- Perfluoroundecanoic acid (PFUdA)
- Perfluorododecanoic acid (PFDoA)
- Perfluorotridecanoic Acid (PRTrDA)
- Perfluorotetradecanoic acid (PFTA)
- Perfluorobutanesulfonic acid (PFBS)
- Perfluorohexanesulfonic acid (PFHxS)
- Perfluorooctanesulfonic acid (PFOS)

- Perfluorodecanesulfonic Acid (PFDS)
- Perfluorobutanoic Acid (PFBA)
- Perfluoropentanoic Acid (PFPeA)
- Perfluoroheptane Sulfonic Acid (PFHpS)
- 1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2 FTS)
- 1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2 FTS)
- Perfluorooctanesulfonamide (FOSA)
- N-methyl perfluorooctanesulfonamidoacetic acid (MeFOSAA)
- N-ethylperfluorooctanesulfonamidoacetic acid (EtFOSAA)

PFAS analysis will be performed according to USEPA Method 537 Modified with a reporting limit of 2 nanograms per liter (ng/L).

PFAS compounds have been identified in myriad personal care products, sampling materials and field supplies. To limit potential cross contamination field staff will employ the following measures:

- Appropriate personal protective equipment (PPE) will be donned as needed, including boot covers and PVC rain coats
- Field staff will limit use of fragrances and other personal care products containing conditioning agents
- Depth to water measurements will be collected following sample collection
- PFAS groundwater samples will be collected with a peristaltic pump and dedicated highdensity polyethylene (HDPE) tubing
- Dedicated sampling equipment (e.g. nitrile gloves) will be used for PFAS sampling
- All sampling equipment to be reused between sampling locations (e.g. water quality meter flow through cell) will be decontaminated with Alconox and de ionized water
- PFAS groundwater samples will be stored in a dedicated PFAS cooler for onsite storage and transport to the laboratory.
- Blue ice and freezer packs will not be used to cool samples during storage onsite or shipment to the laboratory

Soil Vapor and Ambient Air Sampling

Ten soil vapor points will be installed in accordance with the NYSDOH "Guidance for Evaluating Soil Vapor Intrusion in the State of New York, with updates" (October 2006). Soil vapor points will be installed by advancing a 1.875-inch polyethylene implant with tubing to 2 feet above the groundwater table. Samples will be collected in general accordance with the NYSDOH guidance. Before collecting vapor samples, a minimum of three vapor probe volumes (i.e., the volume of the sample implant and tubing) will be purged from each sample point at a rate of less than 0.2 liters per minute using a RAE Systems MultiRAE® meter. An ambient air sample will be collected concurrently with the soil vapor sample at a height above the ground to represent the breathing zone (about 3 to 5 feet). Soil vapor and ambient air samples will be collected into laboratory-supplied batch-certified clean 2.7- or 6- liter Summa® canisters with calibrated flow controllers for a 2-hour sampling period.

A dust and organic vapor control and monitoring plan will be implemented during investigation activities. A table summarizing the sampling plan as outlined in the RIWP is included in Table 1.1.

1.4 DATA QUALITY OBJECTIVES AND PROCESS

The quality assurance and quality control objectives for all measurement data include:

- **Precision** an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Field sampling precision will be determined by analyzing coded duplicate samples and analytical precision will be determined by analyzing internal QC duplicates and matrix spike duplicates.
- Accuracy a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern. Sampling accuracy will be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy will be assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks.
- **Representativeness** expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness will be determined by assessing a number of investigation procedures, including chain of custody, decontamination, and analysis of field blanks and trip blanks.
- **Completeness** the percentage of measurements made which are judged to be valid. Completeness will be assessed through data validation. The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested.
- **Comparability** expresses the degree of confidence with which one data set can be compared to another. The comparability of all data collected for this project will be ensured using several procedures, including standard methods for sampling and analysis, instrument calibrations, using standard reporting units and reporting formats, and data validation.
- **Sensitivity** the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection.

Each of the above objectives is discussed in detail in Section 3.

TABLE 1

Analytical Methods / Quality Assurance Summary Table

	SOIL					
	<u>Quantity (1)</u>	<u>Analysis (2, 3, 4)</u>				
	98	Total and TCLP lead				
Soil Samples	56	TCL VOCs, TCL SVOCs, pesticides,				
		PCBs, herbicides, and TAL metals				
Duplicate Soil Samples	1 (one per 20 soil samples)	(including all 6 NYCRR Part 375				
		compounds), PFAS, and 1,4-				
Soil Matrix Spike	1 (one per 20 soil samples)					
	GROUNDWATER					
	<u>Quantity</u> (5)	<u>Analysis (2, 3, 4, 6)</u>				
Groundwater Samples	14	TCL VOCs, TCL SVOCs, pesticides,				
	1 (one per 20 groundwater	PCBS, herbicides, TAL metals				
Duplicate Groundwater Samples	samples)	compounds) PEAS and 1 4-				
		Dioxane				
Groundwater Matrix Spike	1 (one per 20 groundwater					
	samples)					
	SOIL VAPOR					
	Quantity	Analysis (2)				
Soil Vapor / Ambient Air Samples	11					
Dunlicate Soil Vanor Samples	1 (one per 20 soil vapor	TO-15 VOCs				
	samples)					
	FIELD AND TRIP BLANKS					
	Quantity	Analysis (2)				
	1 (one per 20 soil samples)					
Soil Field Blanks	or 1 per day when sampling					
	for 1,4-dioxane and/or PFAS	TCL VOCs, TCL SVOCs, pesticides,				
	1 (and not 20)	PCBs, herbicides, and TAL metals				
	groundwater samples) or 1	(including all 6 NYCRR Part 375				
Groundwater Field Blanks	per day when sampling for	compounds)				
	1,4-dioxane and/or PFAS					
Trip Blanks	and groundwater samples	TCL VOCs				
	for VOC analysis					
	,					

<u>Notes</u>

1) Up to two soil samples are proposed for collection at each of proposed soil borings.

2) For details regarding sample containerization, volume requirements, preservation, and holding times for water, soil, and soil vapor samples, refer to tables 4.1, 4.2, and 4.3, respectively.

3) For analytical methods and reporting limits, see Table 7.1.

4) For detailed information on matrix spike and matrix spike duplicate analysis for groundwater and soil samples, see tables 3.1 and 3.2, respectively.

5) Additional samples may be collected based on encountered field conditions.

PFAS = per- and poly-fluoroalkyl substances (PFAS) VOCs = volatile organic compounds SVOCs = semivolatile organic compounds PCBs = polychlorinated biphenyls TCL = target compound list TAL = target analyte list NA = not applicable

6 NYCRR = Title 6 of the New York Codes, Rules and Regulations



Figure 1: Areas of Concern and Proposed Sample Location Plan

2.0 PROJECT ORGANIZATION

The execution of the RIWP will be overseen by Langan on behalf of Alexander's of Rego Park III, Inc. Langan will collect media samples and will subcontract a qualified driller and an Environmental Laboratory Approval Program (ELAP)-certified laboratory. Langan will also perform the data analysis, evaluation, and reporting tasks.

The analytical services will be performed by Alpha Analytical Laboratories, Inc. of Mansfield, MA, New York State Department of Health (NYSDOH) ELAP certification number 11148. Data validation services will be performed by Joe Conboy; resume attached (Attachment C).

Personnel Investigation Role		Contact Information		
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Alpha Analytical	Contractor	Email – <u>brao@alphalab.com</u>		
Joe Conboy	Program	Phone – 609-282-8099		
Langan Engineering	Data Validator	Email – jconboy@langan.com		
To Be Determined	Field Personnel	To Be Determined		

Key contacts for this project are as follows:

3.0 QUALITY ASSURANCE OBJECTIVES FOR COLLECTION OF DATA

3.1 INTRODUCTION

The quality assurance and quality control objectives for all data include precision, accuracy, representativeness, completeness, comparability, and sensitivity. These objectives are defined in following subsections. They are formulated to meet the requirements of the USEPA SW-846. The laboratory will aim to achieve low reporting limits for all analytical methods. The analytical methods and their Contract Required Quantification Limits (CRQLs) are given in Section 7.

3.2 PRECISION

Precision is an expression of the reproducibility of measurements of the same parameter under a given set of conditions. Specifically, it is a quantitative measurement of the variability of a group of measurements compared to their average value (USEPA, 1987). Precision is usually stated in terms of standard deviation, but other estimates such as the coefficient of variation (relative standard deviation), range (maximum value minus minimum value), relative range, and relative percent difference (RPD) are common.

For this project, field sampling precision will be determined by analyzing coded duplicate samples (labeled so that the laboratory does not recognize them as duplicates) for the same parameters, and then, during data validation (Section 8), calculating the RPD for duplicate sample results.

Analytical precision will be determined by the laboratory by calculating the RPD for the results of the analysis of internal QC duplicates and matrix spike duplicates. The formula for calculating RPD is as follows:

$$RPD = \frac{|V1 - V2|}{(V1 + V2)/2} \times 100$$

where:

RPD	=	Relative Percent Difference.
V1, V2	=	The two values to be compared.
V1 – V2	=	The absolute value of the difference between the two values.
(V1 + V2)/2	=	The average of the two values.

The data quality objectives for analytical precision, calculated as the RPD between duplicate analyses, are presented in Tables 2 and 3.

TABLE 2 QUALITY CONTROL LIMITS FOR WATER SAMPLES

		Laboratory Accuracy and Precision							
Analytical Parameters	Analytical Method (a)	Matrix Spike (MS) Compounds	MS/MSD (b) % Recovery	MS/MSD RPD I	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery		
VOCs (e)	8260	1,1-Dichloroethane	61-145	-	NA	Toluene-d8	88-110		
		Trichloroethene	71-120	-	NA	Bromofluorobenzene	86-115		
		Benzene	76-127	-	NA	1,2-Dichloroethane-d4	76-114		
		Toluene	76-125	-	NA				
	Chlorobenzene	75-130	-	NA					
SVOCs (f)	8270	Phenol	12-110	-	NA	Nitrobenzene-d5	35-114		
		2-Chlorophenol	27-123	-	NA	2-Fluorobiphenyl	43-116		
		1,4-Dichlorobenzene	36-97	-	NA	Terphenyl-d14	33-141		
		N-Nitroso-di-n-propylamine	41-116	-	NA	Phenol-d5	10-110		
		1,2,4-Trichlorobenzene	39-98	-	NA	2-Fluorophenol	21-110		
		4-Chloro-3-methylphenol	23-97	-	NA	2,4,6-Tribromophenol	10-123		
		Acenaphthene	46-118	-	NA	2-Chlorophenol-d4	33-110 (g)		
		4-Nitrophenol	10-80	-	NA	1,2-Dichlorobenzene-d4	16-110 (g)		
		2,4-Dinitrotoluene	24-96	-	NA				
		Pentachlorophenol	9-103	-	NA				
		Pyrene	26-127	-	NA				
Inorganics (i)	6010,7470/7471,7 841,9010, OIA- 1677	Inorganic Analyte	75-125 (j)	- (k)	80-120	NA	NA		

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990; any subsequent revisions shall supersede this information

(b) Matrix Spike/Matrix Spike Duplicate

(c) Relative Percent Difference(d) Laboratory Control Sample

(e) TCL VOCs plus library search (f) TCL SVOCs plus library search

(g) Limits are advisory only

(i) Target Analyte List Inorganics (metals) (j)Matrix spike only (k) Laboratory duplicate RPD NA - Not Applicable

TABLE 3 QUALITY CONTROL LIMITS FOR SOIL SAMPLES

Laboratory Accuracy and Precision

Analytical Parameter	Analytical Method (a)	Matrix Spike (MS) Compounds	MS/MSD (b) % Recovery	MS/MSD RPD (c)	LCS (d) % Recovery	Surrogate Compounds	Surrogate % Recovery
VOCs (e)	8260	1,1-Dichloroethane	59-172	22	NA	Toluene-d8	84-138
		Trichloroethene	62-137	24	NA	Bromofluorobenzene	59-113
		Benzene	66-142	21	NA	1,2-Dichloroethane-d4	70-121
		Toluene	59-139	21	NA		
		Chlorobenzene	60-133	21	NA		
SVOCs (f)	8270	Phenol	26-90	35	NA	Nitrobenzene-d5	23-120
		2-Chlorophenol	25-102	50	NA	2-Fluorobiphenyl	30-115
		1,4-Dichlorobenzene	28-104	27	NA	Terphenyl-d14	18-137
		N-Nitroso-di-n-propylamine	41-126	38	NA	Phenol-d5	24-113
		1,2,4-Trichlorobenzene	38-107	23	NA	2-Fluorophenol	25-121
		4-Chloro-3-methylphenol	26-103	33	NA	2,4,6-Tribromophenol	19-122
		Acenaphthene	31-137	19	NA	2-Chlorophenol-d4	20-130 (g)
		4-Nitrophenol	11-114	50	NA	1,2-Dichlorobenzene-d4	20-130 (g)
		2,4-Dinitrotoluene	28-89	47	NA		
		Pentachlorophenol	17-109	47	NA		
		Pyrene	35-142	36	NA		
Inorganics (i)	6010, 7470/7471, 7841, 9010	Inorganic Analyte	75-125 (j)	20 (k)	80-120	NA	NA
PCBs (h)	8082	PCBs (Aroclor 1260)	50-128	50	NA	Tetrachlorometaxylene Decachlorobiphenyl	24-154 25-159

(a) Analytical Methods: USEPA SW-846, 3rd edition, Revision 1, November 1990, any subsequent revisions shall supersede this information

(b) Matrix Spike/Matrix Spike Duplicate

(c) Relative Percent Difference(d) Laboratory Control Sample

(e) TCL VOCs plus library search

(f) TCL SVOCs plus library search

(g) Limits are advisory only

(h) PCBs

(i) Target Analyte List Inorganics (metals and cyanide)

(j) Matrix spike only

(k) Laboratory duplicate RPD

NA - Not Applicable

3.3 ACCURACY

Accuracy is a measure of the degree of agreement of a measured value with the true or expected value of the quantity of concern (Taylor, 1987), or the difference between a measured value and the true or accepted reference value. The accuracy of an analytical procedure is best determined by the analysis of a sample containing a known quantity of material, and is expressed as the percent of the known quantity, which is recovered or measured. The recovery of a given analyte is dependent upon the sample matrix, method of analysis, and the specific compound or element being determined. The concentration of the analyte relative to the detection limit of the analytical method is also a major factor in determining the accuracy of the measurement. Concentrations of analytes, which are close to the detection limits are less accurate because they are more affected by such factors as instrument "noise." Higher concentrations will not be as affected by instrument noise or other variables and thus will be more accurate.

Sampling accuracy may be determined through the assessment of the analytical results of field blanks and trip blanks for each sample set. Analytical accuracy is typically assessed by examining the percent recoveries of surrogate compounds that are added to each sample (organic analyses only), and the percent recoveries of matrix spike compounds added to selected samples and laboratory blanks. Additionally, initial and continuing calibrations must be performed and accomplished within the established method control limits to define the instrument accuracy before analytical accuracy can be determined for any sample set.

Accuracy is normally measured as the percent recovery (%R) of a known amount of analyte, called a spike, added to a sample (matrix spike) or to a blank (blank spike). The %R is calculated as follows:

where:

%R = Percent recovery.

- SSR = Spike sample result: concentration of analyte obtained by analyzing the sample with the spike added.
- SR = Sample result: the background value, i.e., the concentration of the analyte obtained by analyzing the sample.
- SA = Spiked analyte: concentration of the analyte spike added to the sample.

The acceptance limits for accuracy for each parameter are presented in Tables 2 and 3.

3.4 REPRESENTATIVENESS

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is a qualitative parameter, which is most concerned with the proper design of the sampling program (USEPA, 1987). Samples must be representative of the environmental media being sampled. Selection of sample locations and sampling procedures will incorporate consideration of obtaining the most representative sample possible.

Field and laboratory procedures will be performed in such a manner as to ensure, to the degree that is technically possible, that the data derived represents the in-place quality of the material sampled. Every effort will be made to ensure chemical compounds will not be introduced into the sample via sample containers, handling, and analysis. Decontamination of sampling devices and digging equipment will be performed between samples as outlined in the Field Sampling Plan. Analysis of field blanks, trip blanks, and method blanks will also be performed to monitor for potential sample contamination from field and laboratory procedures.

The assessment of representativeness also must consider the degree of heterogeneity in the material from which the samples are collected. Sampling heterogeneity will be evaluated during data validation through the analysis of coded field duplicate samples. The analytical laboratory will also follow acceptable procedures to assure the samples are adequately homogenized prior to taking aliquots for analysis, so the reported results are representative of the sample received.

Chain-of-custody procedures will be followed to document that contamination of samples has not occurred during container preparation, shipment, and sampling. Details of blank, duplicate and Chain-of-custody procedures are presented in Sections 4 and 5.

3.5 COMPLETENESS

Completeness is defined as the percentage of measurements made which are judged to be valid (USEPA, 1987). The QC objective for completeness is generation of valid data for at least 90 percent of the analyses requested. Completeness is defined as follows for all sample measurements:

where:

%C = Percent completeness.

V = Number of measurements judged valid.

T = Total number of measurements.

3.6 COMPATABILITY

Comparability expresses the degree of confidence with which one data set can be compared to another (USEPA, 1987). The comparability of all data collected for this project will be ensured by:

- Using identified standard methods for both sampling and analysis phases of this project;
- Requiring traceability of all analytical standards and/or source materials to the USEPA or National Institute of Standards and Technology (NIST);
- Requiring that all calibrations be verified with an independently prepared standard from a source other than that used for calibration (if applicable);
- Using standard reporting units and reporting formats including the reporting of QC data;
- Performing a complete data validation on a representative fraction of the analytical results, including the use of data qualifiers in all cases where appropriate; and
- Requiring that all validation qualifiers be used any time an analytical result is used for any purpose.

These steps will ensure all users of either the data or the conclusions drawn from them will be able to judge the comparability of the data and conclusions.

3.7 SENSITIVITY

Sensitivity is the ability of the instrument or method to detect target analytes at the levels of interest. The project manager will select, with input from the laboratory and QA personnel, sampling and analytical procedures that achieve the required levels of detection and QC acceptance limits that meet established performance criteria. Concurrently, the project manager will select the level of data assessment to ensure that only data meeting the project data quality objectives are used in decision-making.

Field equipment will be used that can achieve the required levels of detection for analytical measurements in the field. In addition, the field sampling staff will collect and submit full volumes of samples as required by the laboratory for analysis, whenever possible. Full volume aliquots will help ensure achievement of the required limits of detection and allow for reanalysis if necessary. The concentration of the lowest level check standard in a multi-point calibration curve will represent the reporting limit.

Analytical methods and quality assurance parameters associated with the sampling program are presented in Table 1. The frequency of associated equipment blanks and duplicate samples will

be based on the recommendations listed in DER-10 and as described in Table 1. One equipment blank per day per matrix will be collected for PFAS and 1,4-dioxane.

Site-specific MS and MSD samples will be prepared and analyzed by the analytical laboratory by spiking an aliquot of submitted sample volume with analytes of interest. Additional sample volume is not required by the laboratory for this purpose. An MS/MSD analysis will be analyzed at a rate of 1 out of every 20 samples, or one per analytical batch. MS/MSD samples are only required for soil and groundwater samples.

4.0 SAMPLING PROGRAM

4.1 INTRODUCTION

Soil and groundwater sampling will be conducted in accordance with the established NYSDEC protocols contained in DER-10. Air sampling will be conducted in accordance with the established NYSDOH protocols contained in the *Guidance for Evaluating Soil Vapor Intrusion in the State of New York* (October 2006). The following sections describe procedures to be followed for specific tasks.

4.2 SAMPLE NOMENCLATURE

The sample nomenclature system was devised such that the following objectives can be attained (see Attachment D):

- Sorting of data by matrix;
- Sorting of data by depth;
- Maintenance of consistency (filed, laboratory, and database sample numbers);
- Accommodation of all project-specific requirements; and
- Accommodation of laboratory sample number length constraints (maximum 20 characters).

4.3 SAMPLE CONTAINER PREPARATION AND SAMPLE PRESERVATION

Sample containers will be properly washed and decontaminated prior to their use by either the analytical laboratory or the container vendor to the specifications required by the USEPA. Copies of the sample container QC analyses will be provided by the laboratory for each container lot used to obtain samples. The containers will be labeled and the appropriate preservatives will be added. The types of containers are shown in Tables 4 and 5.

Samples shall be preserved according to the preservation techniques given in Tables 4 and 5. Preservatives will be added to the sample bottles by the laboratory prior to their shipment in sufficient quantities to ensure that proper sample pH is met. Following sample collection, the sample bottles should be placed on ice in the shipping cooler, cooled to 4°C with ice in Ziploc® bags (or equivalent), and delivered to the laboratory within 48 hours of collection. Chain-of-custody procedures are described in Section 5.

4.4 SAMPLE HOLDING TIMES

The sample holding times for organic and inorganic parameters are given in Tables 4 and 5 and must be in accordance with the USEPA requirements for each method. The USEPA technical

holding times must be strictly adhered to by the laboratory. Any holding time exceedances must be reported to Langan.

4.5 FIELD QC SAMPLES

To assess cross-contamination and effectiveness of equipment decontamination, two types of "blanks" will be collected and submitted to the laboratory for analyses. In addition, the precision of field sampling procedures will be assessed by collecting coded field duplicates and matrix spike/matrix spike duplicates (MS/MSDs). The blanks will include:

- a. Trip Blanks A trip blank will be prepared before the sample containers are sent by the laboratory. The trip blank will consist of a 40-ml vials containing distilled, deionized water, which accompanies the other water sample bottles into the field and back to the laboratory. A trip blank will be included with each shipment of water samples for Part 375 volatiles analysis. The trip blank will be analyzed for volatile organic compounds to assess any contamination from sampling and transport, and internal laboratory procedures.
- Equipment Blanks Equipment blanks will be collected for quality assurance purposes at a rate of one per 20 investigative samples per matrix (soil and groundwater only). Equipment blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or through a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided sample container for analysis. Equipment blank samples will be analyzed for the complete list of analytes on the day of sampling.
- c. PFAS Equipment Blanks A PFAS equipment blank will be prepared each day that PFAS sampling occurs. PFAS equipment blanks will be obtained by pouring laboratory-demonstrated analyte-free water on or throughout a decontaminated sampling device following use and implementation of decontamination protocols. The water will be collected off of the sampling device into a laboratory-provided HDPE sample container for analysis. The PFAS equipment blank will be analyzed for PFAS via USEPA Method 537 Modified.

The duplicates will include:

a. **Coded Field Duplicate** - To determine the representativeness of the sampling methods, coded field duplicates will be collected at a minimum frequency of one per 20 field samples for each matrix (soil, groundwater, and soil vapor). The samples are termed "coded" because they will be labeled in such a manner that the laboratory will not be able to determine that they are a duplicate sample. This will eliminate any possible bias that could arise.

b. **Matrix Spike/Matrix Spike Duplicate (MS/MSD)** - MS/MSD samples (MS/MSD for organics; MS and laboratory duplicate for inorganics) will be taken at a frequency of one pair per 20 field samples (soil and groundwater). These samples are used to assess the effect of the sample matrix on the recovery of target compounds or target analytes. The percent recoveries and RPDs are given in Tables 2 and 3.

4.6 DECONTAMINATION PROCEDURES

Decontamination procedures will be used for non-dedicated sampling equipment. Decontamination of field personnel is discussed in the site-specific HASP. Field sampling equipment that is to be reused will be decontaminated in the field in accordance with the following procedures:

- 1. Laboratory-grade glassware detergent and tap water scrub to remove visual contamination
- 2. Generous tap water rinse
- 3. Distilled/de-ionized water rinse

4.7 RESIDUALS MANAGEMENT

Debris (e.g., paper, plastic and disposable PPE) will be collected in plastic garbage bags and disposed of as non-hazardous industrial waste. Debris is expected to be transported to a local municipal landfill for disposal. Drill cuttings will be placed back in the borehole from which it was sampled unless the soil is grossly-contaminated. If gross contamination is observed, soil will be collected and stored in Department of Transportation (DOT)-approved 55-gallon drums in a designated storage area at the site. Grossly-contaminated drill cuttings contained in drums will be stored in a designated storage area at the site and will be analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations.

Residual fluids (such as purge water) will be collected and stored in DOT-approved (or equivalent) 55-gallon drums in a designated storage area at the site. The residual fluids will be analyzed, characterized and disposed off-site in accordance with applicable federal and state regulations. Residual fluids such as decontamination water may be discharged to the ground surface; however, if gross contamination is observed, the residual fluids will be collected, stored, and transported similar purge water or other residual fluids.

TABLE 4

WATER SAMPLE CONTAINERIZATION, PRESERVATION, AND HOLDING TIMES

Analysis	Bottle Type	Preservation ^(a)	Holding Time ^(b)
VOCs	40 mL glass VOA vials w/ Teflon-lined cap	HCl pH<2, Cool to 4 ⁰ C	14 days
SVOCs	1000 mL glass w/ Teflon-lined cap	Cool to 4 ^o C	7 days*
PCBs	1000 mL glass w/ Teflon-lined cap	Cool to 4 ⁰ C	7 days**
Metals	1000 mL plastic bottle	HNO_3 to pH < 2 Cool to $4^{O}C$	180 days, except mercury (28 days)
1,4-Dioxane	1000 mL glass w/ Teflon-lined cap	Cool to 4 ⁰ C	7 days**
PFAS	250 mL HDPE bottles	Cool to 4 ^o C	14 days

(a) All samples to be preserved in ice during collection and transport. Select samples preserved with hydrochloric acid (HCI) and nitric acid (HNO₃) as noted.

(b) Days from date of sample collection.

- * Continuous liquid-liquid extraction is the required extraction for water samples for SVOCs. Continuous liquid-liquid extraction and concentration of water samples for SVOC analysis completed within 7 days from the date of sample collection. Extracts of water samples must be analyzed within 40 days of extraction.
- ** Procedures for extraction and concentration of water samples for PCBs must be completed within 7 days from the date of sample collection. Extracts of water samples must be analyzed within 40 days of extraction.

TABLE 5

SOIL SAMPLE

CONTAINERIZATION, PRESERVATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation ^(a)	Holding Time ^(b)
VOCs	40 mL glass VOA vials or 5-g Encore samplers	Cool to 4 ⁰ C, MeOH (VOA vials)	14 days*
SVOCs	Wide-mouth glass w/ Teflon lined cap	Cool to 4 ^o C	14 days*
Metals	Wide-mouth plastic or glass	Cool to 4 ^o C	180 days, except mercury (28 days)
PCBs	Wide-mouth glass w/ Teflon-lined cap	Cool to 4 ^o C	14 days**
Herbicides	Wide-mouth glass w/ Teflon-lined cap	Cool to 4 ^o C	14 days**
Cyanide, Total	Wide-mouth glass w/ Teflon-lined cap	Cool to 4 ^o C	14 days
Hexavalent Chromium	Wide-mouth glass w/ Teflon-lined cap	Cool to 4 ^o C	30 Days
1,4-Dioxane	40 mL glass VOA vials or 5-g Encore samplers	Cool to 4 ^o C MeOH (VOA vials)	14 days *
PFAS	8-oz HDPE bottles	Cool to 4 ^o C	28 days

(a) All samples to be preserved in ice during collection and transport. Samples collected for VOC analysis in VOA vials are preserved with methanol (MeOH).

(b) Days from date of sample collection.

* Samples collected for VOC analysis using Encore samplers must be analyzed within 48 hours unless frozen. Samples frozen within 48 hours can be analyzed up to 14 days from the date of sample collection.

- * Soxhlet or sonication procedures for extraction and concentration of soil/waste samples for SVOCs must be completed within 14 days from the date of sample collection. Extracts of soil samples must be analyzed within 40 days of extraction.
- ** Procedures for extraction and concentration of soil/waste samples for PCBs and herbicides must be completed within 14 days from the date of sample collection. Extracts of soil samples must be analyzed within 40 days of extraction.

TABLE 6SOIL VAPOR, INDOOR AIR, AND AMBIENT AIR SAMPLESCONTAINERIZATION PRESENTATION AND HOLDING TIMES

Analysis	Bottle Type	Preservation	Holding Time ^(a)
VOCs	Summa Canister	None	30 days

(a) Days from date of sample collection.

* Summa canisters will be batch-certified by the analytical laboratory.

5.0 SAMPLE SHIPMENT, TRACKING AND CUSTODY

5.1 INTRODUCTION

This section presents sample custody procedures for both the field and laboratory. Implementation of proper custody procedures for samples generated in the field is the responsibility of field personnel. Both laboratory and field personnel involved in the Chain-of-custody (COC) and transfer of samples will be trained as to the purpose and procedures prior to implementation.

Evidence of sample traceability and integrity is provided by COC procedures. These procedures document the sample traceability from the selection and preparation of the sample containers by the laboratory, to sample collection, to sample shipment, to laboratory receipt and analysis. The sample custody flowchart is shown in Figure 2. A sample is considered to be in a person's custody if the sample is:

- In his/her possession;
- Maintained in view after possession is accepted and documented;
- Locked and tagged with custody seals so that no one can tamper with it after having been in physical custody; or
- In a secured area, restricted to authorized personnel.

5.2 PACKAGING

Air samples canisters can be stored and transported without additional packaging. Soil and groundwater sample containers will be placed in plastic coolers. Ice in Ziploc[®] bags (or equivalent) will be placed around sample containers. Cushioning material will be added around the sample containers if necessary. COCs and other paperwork will be placed in a Ziploc[®] bag (or equivalent) and placed inside the cooler. The cooler will be taped closed and custody seals will be affixed to one side of the cooler at a minimum. If the samples are being shipped by an express delivery company (e.g. FedEx) then laboratory address labels will be placed on top of the cooler

5.3 SHIPPING

Standard procedures to be followed for shipping environmental samples to the analytical laboratory are outlined below.

• All environmental samples will be transported to the laboratory by a laboratory-provided courier under the chain-of-custody protocols.
Prior notice will be provided to the laboratory regarding when to expect shipped samples. If the number, type or date of shipment changes due to site constraints or program changes, the laboratory will be informed.

5.4 FIELD SAMPLE CUSTODY

A COC record (Figure 3 or similar) accompanies the sample containers from selection and preparation at the laboratory, during shipment to the field for sample containment and preservation, and during return to the laboratory. Triplicate copies of the COC must be completed for each sample set collected.

The COC lists the field personnel responsible for taking samples, the project name and number, the name of the analytical laboratory to which the samples are sent, and the method of sample shipment. The COC also lists a unique description of every sample bottle in the set. If samples are split and sent to different laboratories, a copy of the COC record will be sent with each sample.

The *REMARKS* space on the COC is used to indicate if the sample is a matrix spike, matrix spike duplicate, or any other sample information for the laboratory. Since they are not specific to any one sample point, trip and field blanks are indicated on separate rows. Once all bottles are properly accounted for on the form, a sampler will write his or her signature and the date and time on the first *RELINQUISHED BY* space. The sampler will also write the method of shipment, the shipping cooler identification number, and the shipper airbill number on the top of the COC.







* REQUIRES SIGN-OFF ON CHAIN-OF-CUSTODY FORM

Figure 3: Sample Chain-of-Custody Form A = None B = HCI $C = HNO_3$ $D = H₂SO_4$ F = MaOH F = MaOH $G = NaHSO_4$ $H = Na_5S_2O_3$ K/E = Zn Ac/NaOH0 = Other Other project specific requirements/comments: Westborough, MA 01581 8 Walkup Dr. TEL: 508-898-9220 FAX: 508-898-9193 orm No: 01-25 HC (rev. 30-Sept-2013) hone: Address lient ax lease specify Metals or TAL. mai nese samples have been previously analyzed by Alpha eservative Code Client Information ALPHA Lab ID (Lab Use Only) winter of O = Other E = Encore D = BOD Bottle P = Plastic A = Amber Glass V = Vial B = Bacteria Cup C = Cube G = GlassContainer Code Mansfield, MA 02048 320 Forbes Blvd TEL: 508-822-9300 FAX: 508-822-3288 CUSTODY Sample ID Mansfield: Certification No: MA015 Westboro: Certification No: MA935 Project Manager Project Name: Service Centers Mahwah, NJ 07430: 35 Whithey Rd, Suite 5 Albany, NY 12205: 14 Walker Way Tonawanda, NY 14150: 275 Cooper Ave, Suite 105 ALPHAQuote #: (Use Project name as Project #) Project # Project Location: Rush (only if pre approved) Project Information Turn-Around Time Relinguished By Standard Date Collection # of Days Due Date Time Date/Time Matrix Sample Container Type Preservative Sampler's Initials Received By Deliverables ANALYSIS Regulatory Requiremen EQuIS (1 File) NY Restricted Use _ NY TOGS Date Rec'd in Lab Other ASP-A NYC Sewer Discharge NY Unrestricted Use AWQ Standards EQuIS (4 File) Other ASP-B NY CP-51 NY Part 375 Date/Time Preservation PO # turnaround time clock will not start until any ambiguities are resolved. BY EXECUTING THIS COC, THE CLIENT applicable disposal facilities. Disposal Facility: Sample Filtration Please identify below location of Disposal Site Information **Billing Information** Please Specify below) HAS READ AND AGREES not be logged in and and completely. Samples can Please print clearly, legibly (See reverse side.) TO BE BOUND BY ALPHA'S mple Specific Comments Done **TERMS & CONDITIONS** Lab to do Other: Z Same as Client Info Ϋ́

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One copy of the COC is retained by sampling personnel (notations identifying blind duplicate samples will be added to this copy of the COC, but not the others that will go to the laboratory) and the other two copies are put into a sealable plastic bag and taped inside the lid of the shipping cooler. The cooler lid is closed, custody seals provided by the laboratory are affixed to the latch and across the back and front lids of the cooler, and the person relinquishing the samples signs their name across the seal. The seal is taped, and the cooler is wrapped tightly with clear packing tape. It is then relinquished by field personnel to personnel responsible for shipment, typically an overnight carrier. The COC seal must be broken to open the container. Breakage of the seals before receipt at the laboratory may indicate tampering. If tampering is apparent, the laboratory will contact the Project Manager, and the sample will not be analyzed.

5.5 LABORATORY SAMPLE CUSTODY

The Project Manager or Field Team Leader will notify the laboratory of upcoming field sampling activities, and the subsequent shipment of samples to the laboratory. This notification will include information concerning the number and type of samples to be shipped as well as the anticipated date of arrival.

The following laboratory sample custody procedures will be used:

- The laboratory will designate a sample custodian who will be responsible for maintaining custody of the samples, and for maintaining all associated records documenting that custody.
- Upon receipt of the samples, the custodian will check cooler temperature, and check the original COC documents and compare them with the labeled contents of each sample container for correctness and traceability. The sample custodian will sign the COC record and record the date and time received.
- Care will be exercised to annotate any labeling or descriptive errors. In the event of discrepant documentation, the laboratory will immediately contact the Project Manager or Field Team Leader as part of the corrective action process. A qualitative assessment of each sample container will be performed to note any anomalies, such as broken or leaking bottles. This assessment will be recorded as part of the incoming chain-of-custody procedure.
- The samples will be stored in a secured area at a temperature of approximately 4°C until analyses commence.

- A laboratory tracking record will accompany the sample or sample fraction through final analysis for control.
- A copy of the tracking record will accompany the laboratory report and will become a permanent part of the project records.

6.0 CALIBRATION PROCEDURES

6.1 FIELD INSTRUMENTS

A PID will be used during the sampling activities to evaluate work zone action levels, collect preand post-sample readings for air samples, screen soil samples, and collect monitoring well headspace readings. Field calibration and/or field checking of the PID will be the responsibility of the field team leader and will be accomplished by following the procedures outlined in the operating manual for the instrument. At a minimum, field calibration and/or field equipment checking will be performed once daily, prior to use. Field calibration will be documented in the field notebook. Entries made into the logbook regarding the status of field equipment will include the following information:

- Date and time of calibration
- Type of equipment serviced and identification number (such as serial number)
- Reference standard used for calibration
- Calibration and/or maintenance procedure used
- Other pertinent information

A water quality meter (Horiba U-52 or similar) will be used during purging and sampling of groundwater to measure pH, specific conductance, temperature, dissolved oxygen, turbidity and oxidation-reduction-potential (ORP) every five minutes. Water-quality meters should be calibrated and the results documented before use each day using standardized field calibration procedures and calibration checks.

Equipment that fails calibration or becomes inoperable during use will be removed from service and segregated to prevent inadvertent utilization. The equipment will be properly tagged to indicate that it is out of calibration. Such equipment will be repaired and recalibrated to the manufacturer's specifications by qualified personnel. Equipment that cannot be repaired will be replaced.

Off-site calibration and maintenance of field instruments will be conducted as appropriate throughout the duration of project activities. All field instrumentation, sampling equipment and accessories will be maintained in accordance with the manufacturer's recommendations and specifications and established field equipment practice. Off-site calibration and maintenance will be performed by qualified personnel. A logbook will be kept to document that established calibration and maintenance procedures were followed. Documentation will include both scheduled and unscheduled maintenance.

6.2 LABORATORY INSTRUMENTS

The laboratory will follow all calibration procedures and schedules as specified in the sections of the USEPA SW-846 and subsequent updates that apply to the instruments used for the analytical methods given in Section 7.

7.0 ANALYTICAL PROCEDURES

7.1 INTRODUCTION

Samples will be analyzed according to the USEPA SW-846 "Test Methods for Evaluating Solid Waste," November 1986, 3rd edition and subsequent updates. The methods for the laboratory analysis of soil, water, and air samples and the quantitation limits presented in Table 7.

	PROJECT	TABLE 7 QUANTITATION LIMIT	rs - Soil	
			Estimated Qua (S	antitation Limits Soil)
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
	VOCs			
1	Methylene chloride	8260C/5035	0.01	0.00165
2	1,1-Dichloroethane	8260C/5035	0.0015	0.00027
3	Chloroform	8260C/5035	0.0015	0.00037
4	Carbon tetrachloride	8260C/5035	0.001	0.000345
5	1,2-Dichloropropane	8260C/5035	0.0035	0.000228
6	Dibromochloromethane	8260C/5035	0.001	0.000176
7	1,1,2-Trichloroethane	8260C/5035	0.0015	0.000313
8	Tetrachloroethene	8260C/5035	0.001	0.000302
9	Chlorobenzene	8260C/5035	0.001	0.000348
10	Trichlorofluoromethane	8260C/5035	0.005	0.000417
11	1,2-Dichloroethane	8260C/5035	0.001	0.000246
12	1,1,1-Trichloroethane	8260C/5035	0.001	0.00035
13	Bromodichloromethane	8260C/5035	0.001	0.000308
14	trans-1,3-Dichloropropene	8260C/5035	0.001	0.000208
15	cis-1,3-Dichloropropene	8260C/5035	0.001	0.000231
16	1,3-Dichloropropene, Total	8260C/5035	0.001	0.000208
17	1,1-Dichloropropene	8260C/5035	0.005	0.000328
18	Bromoform	8260C/5035	0.004	0.000237
19	1,1,2,2-Tetrachloroethane	8260C/5035	0.001	0.000298
20	Benzene	8260C/5035	0.001	0.000193
21	Toluene	8260C/5035	0.0015	0.000195
22	Ethylbenzene	8260C/5035	0.001	0.00017
23	Chloromethane	8260C/5035	0.005	0.000436
24	Bromomethane	8260C/5035	0.002	0.000338
25	Vinyl chloride	8260C/5035	0.002	0.000315
26	Chloroethane	8260C/5035	0.002	0.000316
27	1,1-Dichloroethene	8260C/5035	0.001	0.000372
28	trans-1,2-Dichloroethene	8260C/5035	0.0015	0.000241
29	Trichloroethene	8260C/5035	0.001	0.000302

			Estimated Qua	antitation Limits Soil)
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
30	1,2-Dichlorobenzene	8260C/5035	0.005	0.000182
31	1,3-Dichlorobenzene	8260C/5035	0.005	0.000218
32	1,4-Dichlorobenzene	8260C/5035	0.005	0.000182
33	Methyl tert butyl ether	8260C/5035	0.002	0.000153
34	p/m-Xylene	8260C/5035	0.002	0.000351
35	o-Xylene	8260C/5035	0.002	0.000338
36	Xylene (Total)	8260C/5035	0.002	0.000338
37	cis-1,2-Dichloroethene	8260C/5035	0.001	0.000342
38	1,2-Dichloroethene (total)	8260C/5035	0.001	0.000241
39	Dibromomethane	8260C/5035	0.01	0.000239
40	Styrene	8260C/5035	0.002	0.000401
41	Dichlorodifluoromethane	8260C/5035	0.01	0.0005
42	Acetone	8260C/5035	0.01	0.00229
43	Carbon disulfide	8260C/5035	0.01	0.0011
44	2-Butanone	8260C/5035	0.01	0.00069
45	Vinyl acetate	8260C/5035	0.01	0.000153
46	4-Methyl-2-pentanone	8260C/5035	0.01	0.000244
47	1,2,3-Trichloropropane	8260C/5035	0.01	0.000177
48	2-Hexanone	8260C/5035	0.01	0.000666
49	Bromochloromethane	8260C/5035	0.005	0.000357
50	2,2-Dichloropropane	8260C/5035	0.005	0.00045
51	1,2-Dibromoethane	8260C/5035	0.004	0.000199
52	1,3-Dichloropropane	8260C/5035	0.005	0.000183
53	1,1,1,2-Tetrachloroethane	8260C/5035	0.001	0.000318
54	Bromobenzene	8260C/5035	0.005	0.000219
55	n-Butylbenzene	8260C/5035	0.001	0.000228
56	sec-Butylbenzene	8260C/5035	0.001	0.000217
57	tert-Butylbenzene	8260C/5035	0.005	0.000247
58	o-Chlorotoluene	8260C/5035	0.005	0.000221
59	p-Chlorotoluene	8260C/5035	0.005	0.000183
60	1,2-Dibromo-3-chloropropane	8260C/5035	0.005	0.000396
61	Hexachlorobutadiene	8260C/5035	0.005	0.000348
62	Isopropylbenzene	8260C/5035	0.001	0.000194
63	p-lsopropyltoluene	8260C/5035	0.001	0.000202
64	Naphthalene	8260C/5035	0.005	0.000138
65	Acrylonitrile	8260C/5035	0.01	0.000514
66	n-Propylbenzene	8260C/5035	0.001	0.000215

 TABLE 7

 PROJECT QUANTITATION LIMITS - SOIL

			Estimated Qua	antitation Limits
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
67	1,2,3-Trichlorobenzene	8260C/5035	0.005	0.000251
68	1,2,4-Trichlorobenzene	8260C/5035	0.005	0.000215
69	1,3,5-Trimethylbenzene	8260C/5035	0.005	0.000161
70	1,2,4-Trimethylbenzene	8260C/5035	0.005	0.000186
71	1,4-Dioxane	8260C/5035	0.04	0.0144
72	1,4-Diethylbenzene	8260C/5035	0.004	0.004
73	4-Ethyltoluene	8260C/5035	0.004	0.000234
74	1,2,4,5-Tetramethylbenzene	8260C/5035	0.004	0.000156
75	Ethyl ether	8260C/5035	0.005	0.00026
76	trans-1,4-Dichloro-2-butene	8260C/5035	0.005	0.000392
	SVOCs			
1	Acenaphthene	8270D	0.1332	0.0172494
2	1,2,4-Trichlorobenzene	8270D	0.1665	0.0190476
3	Hexachlorobenzene	8270D	0.0999	0.018648
4	Bis(2-chloroethyl)ether	8270D	0.14985	0.0225774
5	2-Chloronaphthalene	8270D	0.1665	0.0165168
6	1,2-Dichlorobenzene	8270D	0.1665	0.0299034
7	1,3-Dichlorobenzene	8270D	0.1665	0.028638
8	1,4-Dichlorobenzene	8270D	0.1665	0.0290709
9	3,3'-Dichlorobenzidine	8270D	0.1665	0.044289
10	2,4-Dinitrotoluene	8270D	0.1665	0.0333
11	2,6-Dinitrotoluene	8270D	0.1665	0.0285714
12	Fluoranthene	8270D	0.0999	0.0191142
13	4-Chlorophenyl phenyl ether	8270D	0.1665	0.0178155
14	4-Bromophenyl phenyl ether	8270D	0.1665	0.0254079
15	Bis(2-chloroisopropyl)ether	8270D	0.1998	0.0284382
16	Bis(2-chloroethoxy)methane	8270D	0.17982	0.0166833
17	Hexachlorobutadiene	8270D	0.1665	0.0243756
18	Hexachlorocyclopentadiene	8270D	0.47619	0.150849
19	Hexachloroethane	8270D	0.1332	0.0269397
20	Isophorone	8270D	0.14985	0.0216117
21	Naphthalene	8270D	0.1665	0.0202797
22	Nitrobenzene	8270D	0.14985	0.024642
23	NitrosoDiPhenylAmine(NDPA)/DPA	8270D	0.1332	0.0189477
24	n-Nitrosodi-n-propylamine	8270D	0.1665	0.0257076
25	Bis(2-Ethylhexyl)phthalate	8270D	0.1665	0.057609

TABLE 7 PROJECT QUANTITATION LIMITS - SOIL

			Estimated Qua (S	antitation Limits Soil)
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
26	Butyl benzyl phthalate	8270D	0.1665	0.041958
27	Di-n-butylphthalate	8270D	0.1665	0.0315684
28	Di-n-octylphthalate	8270D	0.1665	0.05661
29	Diethyl phthalate	8270D	0.1665	0.0154179
30	Dimethyl phthalate	8270D	0.1665	0.034965
31	Benzo(a)anthracene	8270D	0.0999	0.0187479
32	Benzo(a)pyrene	8270D	0.1332	0.040626
33	Benzo(b)fluoranthene	8270D	0.0999	0.0280386
34	Benzo(k)fluoranthene	8270D	0.0999	0.02664
35	Chrysene	8270D	0.0999	0.017316
36	Acenaphthylene	8270D	0.1332	0.0257076
37	Anthracene	8270D	0.0999	0.0324675
38	Benzo(ghi)perylene	8270D	0.1332	0.0195804
39	Fluorene	8270D	0.1665	0.0161838
40	Phenanthrene	8270D	0.0999	0.0202464
41	Dibenzo(a,h)anthracene	8270D	0.0999	0.0192474
42	Indeno(1,2,3-cd)Pyrene	8270D	0.1332	0.0232101
43	Pyrene	8270D	0.0999	0.0165501
44	Biphenyl	8270D	0.37962	0.038628
45	4-Chloroaniline	8270D	0.1665	0.030303
46	2-Nitroaniline	8270D	0.1665	0.0321012
47	3-Nitroaniline	8270D	0.1665	0.0314019
48	4-Nitroaniline	8270D	0.1665	0.068931
49	Dibenzofuran	8270D	0.1665	0.0157509
50	2-Methylnaphthalene	8270D	0.1998	0.0201132
51	Acetophenone	8270D	0.1665	0.0206127
52	2,4,6-Trichlorophenol	8270D	0.0999	0.0315684
53	P-Chloro-M-Cresol	8270D	0.1665	0.0248085
54	2-Chlorophenol	8270D	0.1665	0.0196803
55	2,4-Dichlorophenol	8270D	0.14985	0.0267732
56	2,4-Dimethylphenol	8270D	0.1665	0.054945
57	2-Nitrophenol	8270D	0.35964	0.062604
58	4-Nitrophenol	8270D	0.2331	0.067932
59	2,4-Dinitrophenol	8270D	0.7992	0.077589
60	4,6-Dinitro-o-cresol	8270D	0.4329	0.07992
61	Pentachlorophenol	8270D	0.1332	0.03663
62	Phenol	8270D	0.1665	0.0251415

TABLE 7 PROJECT QUANTITATION LIMITS - SOIL

			Estimated Quantitation Limits (Soil)	
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
63	2-Methylphenol	8270D	0.1665	0.0258075
64	3-Methylphenol/4-Methylphenol	8270D	0.23976	0.0260739
65	2,4,5-Trichlorophenol	8270D	0.1665	0.0319014
66	Benzoic Acid	8270D	0.53946	0.168498
67	Benzyl Alcohol	8270D	0.1665	0.050949
68	Carbazole	8270D	0.1665	0.0161838
	Pesticides			
1	Delta-BHC	8081B	0.007992	0.0015651
2	Lindane	8081B	0.00333	0.00148851
3	Alpha-BHC	8081B	0.00333	0.00094572
4	Beta-BHC	8081B	0.007992	0.0030303
5	Heptachlor	8081B	0.003996	0.00179154
6	Aldrin	8081B	0.007992	0.00281385
7	Heptachlor epoxide	8081B	0.014985	0.0044955
8	Endrin	8081B	0.00333	0.0013653
9	Endrin aldehyde	8081B	0.00999	0.0034965
10	Endrin ketone	8081B	0.007992	0.00205794
11	Dieldrin	8081B	0.004995	0.0024975
12	4,4'-DDE	8081B	0.007992	0.00184815
13	4,4'-DDD	8081B	0.007992	0.00285048
14	4,4'-DDT	8081B	0.014985	0.0064269
15	Endosulfan I	8081B	0.007992	0.00188811
16	Endosulfan II	8081B	0.007992	0.00267066
17	Endosulfan sulfate	8081B	0.00333	0.00152181
18	Methoxychlor	8081B	0.014985	0.004662
19	Toxaphene	8081B	0.14985	0.041958
20	cis-Chlordane	8081B	0.00999	0.00278388
21	trans-Chlordane	8081B	0.00999	0.00263736
22	Chlordane	8081B	0.064935	0.0264735
	Herbicides			
1	2,4,5-TP (Silvex)	8151A	0.1665	0.0044289
	PCBs			
1	Aroclor 1016	8082A	0.0335	0.0026465
2	Aroclor 1221	8082A	0.0335	0.0030887

TABLE 7 PROJECT QUANTITATION LIMITS - SOIL

			Estimated Qua	antitation Limits Soil)
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
3	Aroclor 1232	8082A	0.0335	0.0039262
4	Aroclor 1242	8082A	0.0335	0.0041004
5	Aroclor 1248	8082A	0.0335	0.0028274
6	Aroclor 1254	8082A	0.0335	0.0027537
7	Aroclor 1260	8082A	0.0335	0.0025527
8	Aroclor 1262	8082A	0.0335	0.0016616
9	Aroclor 1268	8082A	0.0335	0.0048575
10	PCBs, Total	8082A	0.0335	0.0016616
	Metals			
1	Aluminum, Total	6010C	4	1.08
2	Antimony, Total	6010C	2	0.152
3	Arsenic, Total	6010C	0.4	0.0832
4	Barium, Total	6010C	0.4	0.0696
5	Beryllium, Total	6010C	0.2	0.0132
6	Cadmium, Total	6010C	0.4	0.0392
7	Calcium, Total	6010C	4	1.4
8	Chromium, Total	6010C	0.4	0.0384
9	Cobalt, Total	6010C	0.8	0.0664
10	Copper, Total	6010C	0.4	0.1032
11	Iron, Total	6010C	2	0.3612
12	Lead, Total	6010C	2	0.1072
13	Magnesium, Total	6010C	4	0.616
14	Manganese, Total	6010C	0.4	0.0636
15	Mercury	7471B	0.08	0.016896
16	Nickel, Total	6010C	1	0.0968
17	Potassium, Total	6010C	100	5.76
18	Selenium, Total	6010C	0.8	0.1032
19	Silver, Total	6010C	0.4	0.1132
20	Sodium, Total	6010C	80	1.26
21	Thallium, Total	6010C	0.8	0.126
22	Vanadium, Total	6010C	0.4	0.0812
23	Zinc, Total	6010C	2	0.1172
	General Chemistry			
1	Cyanide	9010C	0.8	0.16
2	Hexavalent Chromium	7196A	1	0.166

TABLE 7 PROJECT QUANTITATION LIMITS - SOIL

			Estimated Qua (S	antitation Limits Soil)
	Compound	Method	RL (mg/kg)	MDL(mg/kg)
3	Trivalent Chromium	7196	0.8	0.8
	PFAS	Method	RL (µg/kg)	MDL (µg/kg)
1	Perfluorobutanoic Acid (PFBA)	537 Rev 1.15	0.5	0.0227
2	Perfluoropentanoic Acid (PFPeA)	537 Rev 1.15	0.5	0.046
3	Perfluorobutanesulfonic Acid (PFBS)	537 Rev 1.15	0.5	0.039
4	Perfluorohexanoic Acid (PFHxA)	537 Rev 1.15	0.5	0.0525
5	Perfluoroheptanoic Acid (PFHpA)	537 Rev 1.15	0.5	0.0451
6	Perfluorohexanesulfonic Acid (PFHxS)	537 Rev 1.15	0.5	0.0605
7	Perfluorooctanoic Acid (PFOA)	537 Rev 1.15	0.5	0.0419
8	1H,1H,2H,2H-Perfluorooctanesulfonic Acid (6:2FTS)	537 Rev 1.15	0.5	0.1795
9	Perfluoroheptanesulfonic Acid	537 Rev 1.15	05	0 1365
10	Perfluorononanoic Acid (PFNA)	537 Rev 1.15	0.5	0.1305
11	Perfluorooctanesulfonic Acid (PFOS)	537 Rev 1.15	0.5	0.13
12	Perfluorodecanoic Acid (PFDA)	537 Rev 1.15	0.5	0.15
13	1H,1H,2H,2H- Perfluorodecanesulfonic Acid	537 Rev 1.15	0.0	0.007
11	(8:2FTS) N-Methyl Darfware stance ulfan emidea setia	537 Rev 1.15	0.5	0.287
14	Acid (NMeFOSAA)		0.5	0.2015
15	Perfluoroundecanoic Acid (PFUnA)	537 Rev 1.15	0.5	0.0468
16	Perfluorodecanesulfonic Acid (PFDS)	537 Rev 1.15	0.5	0.153
17	Perfluorooctanesulfonamide (FOSA)	537 Rev 1.15	0.5	0.098
18	N-Ethyl Perfluorooctanesulfonamidoacetic	537 Rev 1.15		
	Acid (NEtFOSAA)		0.5	0.0845
19	Perfluorododecanoic Acid (PFDoA)	53/ Rev 1.15	0.5	0.07
20	Pertluorotridecanoic Acid (PFTrDA)	537 Rev 1.15	0.5	0.2045
21	Perfluorotetradecanoic Acid (PFTA)	537 Rev 1.15	0.5	0.054

TABLE 7 **PROJECT QUANTITATION LIMITS - SOIL**

Notes:

1) RL = Reporting Limit

2) MDL = Method Detection Limit

3) RL and MDL values were supplied by Alpha Analytical Laboratories

4) RL and MDL values are estimated and may vary depending on instruments

5) mg/kg = milligram per kilogram

µg/kg = microgram per kilogram 6)

			Estimated Qua (Groun	antitation Limits Idwater)
	Compound	Method	RL (ug/L)	MDL(ug/L)
	VOCs			
1	Methylene chloride	8260C	2.5	0.7
2	1,1-Dichloroethane	8260C	5	0.7
3	Chloroform	8260C	2.5	0.7
4	Carbon tetrachloride	8260C	5	0.134
5	1,2-Dichloropropane	8260C	5	0.133
6	Dibromochloromethane	8260C	5	0.149
7	1,1,2-Trichloroethane	8260C	5	0.5
8	Tetrachloroethene	8260C	5	0.181
9	Chlorobenzene	8260C	5	0.7
10	Trichlorofluoromethane	8260C	5	0.7
11	1,2-Dichloroethane	8260C	2.5	0.132
12	1,1,1-Trichloroethane	8260C	2.5	0.7
13	Bromodichloromethane	8260C	2	0.192
14	trans-1,3-Dichloropropene	8260C	2.5	0.164
15	cis-1,3-Dichloropropene	8260C	2.5	0.144
16	1,3-Dichloropropene, Total	8260C	2.5	0.144
17	1,1-Dichloropropene	8260C	2.5	0.7
18	Bromoform	8260C	2.5	0.65
19	1,1,2,2-Tetrachloroethane	8260C	2.5	0.144
20	Benzene	8260C	2.5	0.159
21	Toluene	8260C	2.5	0.7
22	Ethylbenzene	8260C	2.5	0.7
23	Chloromethane	8260C	2.5	0.7
24	Bromomethane	8260C	2.5	0.7
25	Vinyl chloride	8260C	2.5	0.0699
26	Chloroethane	8260C	2.5	0.7
27	1,1-Dichloroethene	8260C	2.5	0.142
28	trans-1,2-Dichloroethene	8260C	2.5	0.7
29	Trichloroethene	8260C	2.5	0.175
30	1,2-Dichlorobenzene	8260C	2.5	0.7
31	1,3-Dichlorobenzene	8260C	250	0.7
32	1,4-Dichlorobenzene	8260C	2	0.7
33	Methyl tert butyl ether	8260C	2	0.7
34	p/m-Xylene	8260C	2	0.7
35	o-Xylene	8260C	2.5	0.7
36	Xylene (Total)	8260C	2.5	0.7

TABLE 7
PROJECT QUANTITATION LIMITS - GROUNDWATER

	Estimated Quantitation Limits (Groundwater)			
	Compound	Method	RL (ug/L)	MDL(ug/L)
37	cis-1,2-Dichloroethene	8260C	2.5	0.7
38	1,2-Dichloroethene (total)	8260C	2.5	0.7
39	Dibromomethane	8260C	5	1
40	1,2,3-Trichloropropane	8260C	2.5	0.7
41	Acrylonitrile	8260C	5	1.5
42	Styrene	8260C	2.5	0.7
43	Dichlorodifluoromethane	8260C	5	1
44	Acetone	8260C	5	1.46
45	Carbon disulfide	8260C	5	1
46	2-Butanone	8260C	5	1.94
47	Vinyl acetate	8260C	5	1
48	4-Methyl-2-pentanone	8260C	5	1
49	2-Hexanone	8260C	5	1
50	Bromochloromethane	8260C	2.5	0.7
51	2,2-Dichloropropane	8260C	2.5	0.7
52	1,2-Dibromoethane	8260C	2	0.65
53	1,3-Dichloropropane	8260C	2.5	0.7
54	1,1,1,2-Tetrachloroethane	8260C	2.5	0.7
55	Bromobenzene	8260C	2.5	0.7
56	n-Butylbenzene	8260C	2.5	0.7
57	sec-Butylbenzene	8260C	2.5	0.7
58	tert-Butylbenzene	8260C	2.5	0.7
59	o-Chlorotoluene	8260C	2.5	0.7
60	p-Chlorotoluene	8260C	2.5	0.7
61	1,2-Dibromo-3-chloropropane	8260C	2.5	0.7
62	Hexachlorobutadiene	8260C	2.5	0.7
63	Isopropylbenzene	8260C	2.5	0.7
64	p-IsopropyItoluene	8260C	2.5	0.7
65	Naphthalene	8260C	2.5	0.7
66	n-Propylbenzene	8260C	2.5	0.7
67	1,2,3-Trichlorobenzene	8260C	2.5	0.7
68	1,2,4-Trichlorobenzene	8260C	2.5	0.7
69	1,3,5-Trimethylbenzene	8260C	2.5	0.7
70	1,2,4-Trimethylbenzene	8260C	2.5	0.7
71	1,4-Dioxane	8270 SIM Isotope Dilution	0.15	0.075
72	1,4-Diethylbenzene	8260C	2	0.7

TABLE 7 PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Qua (Grour	antitation Limits Idwater)
	Compound	Method	RL (ug/L)	MDL(ug/L)
73	4-Ethyltoluene	8260C	2	0.7
74	1,2,4,5-Tetramethylbenzene	8260C	2	0.65
75	Ethyl ether	8260C	2.5	0.7
76	trans-1,4-Dichloro-2-butene	8260C	2.5	0.7
	SVOCs			
1	Acenaphthene	8270D	2	0.591
2	1,2,4-Trichlorobenzene	8270D	5	0.661
3	Hexachlorobenzene	8270D	2	0.579
4	Bis(2-chloroethyl)ether	8270D	2	0.669
5	2-Chloronaphthalene	8270D	2	0.64
6	1,2-Dichlorobenzene	8270D	2	0.732
7	1,3-Dichlorobenzene	8270D	2	0.732
8	1,4-Dichlorobenzene	8270D	2	0.708
9	3,3'-Dichlorobenzidine	8270D	5	1.39
10	2,4-Dinitrotoluene	8270D	5	0.845
11	2,6-Dinitrotoluene	8270D	5	1.12
12	Fluoranthene	8270D	2	0.568
13	4-Chlorophenyl phenyl ether	8270D	2	0.625
14	4-Bromophenyl phenyl ether	8270D	2	0.731
15	Bis(2-chloroisopropyl)ether	8270D	2	0.696
16	Bis(2-chloroethoxy)methane	8270D	5	0.626
17	Hexachlorobutadiene	8270D	2	0.658
18	Hexachlorocyclopentadiene	8270D	20	7.84
19	Hexachloroethane	8270D	2	0.682
20	Isophorone	8270D	5	0.601
21	Naphthalene	8270D	2	0.68
22	Nitrobenzene	8270D	2	0.753
23	NitrosoDiPhenylAmine(NDPA)/DPA	8270D	2	0.644
24	n-Nitrosodi-n-propylamine	8270D	5	0.7
25	Bis(2-Ethylhexyl)phthalate	8270D	3	0.91
26	Butyl benzyl phthalate	8270D	5	1.26
27	Di-n-butylphthalate	8270D	5	0.689
28	Di-n-octylphthalate	8270D	5	1.14
29	Diethyl phthalate	8270D	5	0.628
30	Dimethyl phthalate	8270D	5	0.65
31	Benzo(a)anthracene	8270D	2	0.61

TABLE 7 PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Qua (Groun	Intitation Limits
	Compound	Method	RL (ug/L)	MDL(ug/L)
32	Benzo(a)pyrene	8270D	2	0.539
33	Benzo(b)fluoranthene	8270D	2	0.635
34	Benzo(k)fluoranthene	8270D	2	0.597
35	Chrysene	8270D	2	0.543
36	Acenaphthylene	8270D	2	0.658
37	Anthracene	8270D	2	0.645
38	Benzo(ghi)perylene	8270D	2	0.611
39	Fluorene	8270D	2	0.619
40	Phenanthrene	8270D	2	0.613
41	Dibenzo(a,h)anthracene	8270D	2	0.548
42	Indeno(1,2,3-cd)Pyrene	8270D	2	0.707
43	Pyrene	8270D	2	0.569
44	Biphenyl	8270D	2	0.757
45	4-Chloroaniline	8270D	5	0.632
46	2-Nitroaniline	8270D	5	1.14
47	3-Nitroaniline	8270D	5	1.14
48	4-Nitroaniline	8270D	5	1.3
49	Dibenzofuran	8270D	2	0.656
50	2-Methylnaphthalene	8270D	2	0.72
51	Acetophenone	8270D	5	0.847
52	2,4,6-Trichlorophenol	8270D	5	0.681
53	P-Chloro-M-Cresol	8270D	2	0.617
54	2-Chlorophenol	8270D	2	0.631
55	2,4-Dichlorophenol	8270D	5	0.769
56	2,4-Dimethylphenol	8270D	5	1.64
57	2-Nitrophenol	8270D	10	1.52
58	4-Nitrophenol	8270D	10	1.77
59	2,4-Dinitrophenol	8270D	20	5.47
60	4,6-Dinitro-o-cresol	8270D	10	2.1
61	Pentachlorophenol	8270D	10	3.43
62	Phenol	8270D	5	1.89
63	2-Methylphenol	8270D	5	1.02
64	3-Methylphenol/4-Methylphenol	8270D	5	1.11
65	2,4,5-Trichlorophenol	8270D	5	0.715
66	Benzoic Acid	8270D	50	12.9
67	Benzyl Alcohol	8270D	2	0.725
68	Carbazole	8270D	2	0.627

 TABLE 7

 PROJECT QUANTITATION LIMITS - GROUNDWATER

			Estimated Quantitation Limits (Groundwater)		
	Compound	Method	RL (ug/L)	MDL(ug/L)	
69	1,4-Dioxane	8270 SIM Isotope Dilution	0.15	0.075	
	Pesticides				
1	Delta-BHC	8081B	0.02	0.00467	
2	Lindane	8081B	0.02	0.00434	
3	Alpha-BHC	8081B	0.02	0.00439	
4	Beta-BHC	8081B	0.02	0.0056	
5	Heptachlor	8081B	0.02	0.0031	
6	Aldrin	8081B	0.02	0.00216	
7	Heptachlor epoxide	8081B	0.02	0.00415	
8	Endrin	8081B	0.04	0.00429	
9	Endrin aldehyde	8081B	0.04	0.0081	
10	Endrin ketone	8081B	0.04	0.00477	
11	Dieldrin	8081B	0.04	0.00429	
12	4,4'-DDE	8081B	0.04	0.00381	
13	4,4'-DDD	8081B	0.04	0.00464	
14	4,4'-DDT	8081B	0.04	0.00432	
15	Endosulfan I	8081B	0.02	0.00345	
16	Endosulfan II	8081B	0.04	0.00519	
17	Endosulfan sulfate	8081B	0.04	0.00481	
18	Methoxychlor	8081B	0.2	0.00684	
19	Toxaphene	8081B	0.2	0.063	
20	cis-Chlordane	8081B	0.02	0.00666	
21	trans-Chlordane	8081B	0.02	0.00627	
22	Chlordane	8081B	0.2	0.0463	
	Herbicides				
1	2,4,5-TP (Silvex)	8151A	2	0.539	
	PCBs				
1	Aroclor 1016	8082A	0.083	0.05478	
2	Aroclor 1221	8082A	0.083	0.05312	
3	Aroclor 1232	8082A	0.083	0.03071	
4	Aroclor 1242	8082A	0.083	0.05976	
5	Aroclor 1248	8082A	0.083	0.05063	
6	Aroclor 1254	8082A	0.083	0.03403	
7	Aroclor 1260	8082A	0.083	0.03154	

TABLE 7
PROJECT QUANTITATION LIMITS - GROUNDWATER

	PROJECT Q	JANTITATION LIMITS - G	ROUNDWATER	ded a 11 14
		Estimated Quantitation Limits (Groundwater)		
	Compound	Method	RL (ug/L)	MDL(ug/L)
8	Aroclor 1262	8082A	0.083	0.02905
9	Aroclor 1268	8082A	0.083	0.03735
10	PCBs, Total	8082A	0.083	0.02905
	Madala			
1		00100		
1	Aluminum, Total	60100	0.00001	0.00000327
2		6010C	0.000004	0.000000429
3	Arsenic, Total	6010C	0.0000005	0.00000165
4	Barium, Total	6010C	0.000005	0.00000173
5	Beryllium, Total	6010C	0.000005	0.00000107
6	Cadmium, Total	6010C	0.000002	0.000000599
7	Calcium, Total	6010C	0.0001	0.0000394
8	Chromium, Total	6010C	0.000001	0.00000178
9	Cobalt, Total	6010C	0.000005	0.00000163
10	Copper, Total	6010C	0.000001	0.00000384
11	Iron, Total	6010C	0.00005	0.0000191
12	Lead, Total	6010C	0.000001	0.00000343
13	Magnesium, Total	6010C	0.00007	0.0000242
14	Manganese, Total	6010C	0.000001	0.00000044
15	Mercury	7040A	0.000002	0.00000066
16	Nickel, Total	6010C	0.000002	0.00000556
17	Potassium, Total	6010C	0.0001	0.0000309
18	Selenium, Total	6010C	0.000005	0.00000173
19	Silver, Total	6010C	0.0000004	0.00000163
20	Sodium, Total	6010C	0.0001	0.0000293
21	Thallium, Total	6010C	0.0000005	0.00000143
22	Vanadium, Total	6010C	0.000005	0.00000157
23	Zinc, Total	6010C	0.00001	0.00000341
	General Chemistry			
1	Cvanide	9010C/9012A	0.00001	0.00003
2	, Hexavalent Chromium	7196A	0.000005	0.0000018
3	Trivalent Chromium	7196	0.00001	0.00001
			Estimated C	Quantitation Limits
	(GroundWater)			
		wiethod		INDL (IIY/L)
	rraj			

TABLE 7

			Estimated Qເ (Grou	uantitation Limits Indwater)
	Compound	Method	RL (ng/L)	MDL (ng/L)
1	Perfluorohexanoic acid (PFHxA)	537 Rev 1.15	2	0.1264
2	Perfluoroheptanoic acid (PFHpA)	537 Rev 1.15	2	0.0924
3	Perfluorooctanoic acid (PFOA)	537 Rev 1.15	2	0.0504
4	Perfluorononanoic acid (PFNA)	537 Rev 1.15	2	0.1008
5	Perfluorodecanoic acid (PFDA)	537 Rev 1.15	2	0.1904
6	Perfluoroundecanoic acid (PFUdA)	537 Rev 1.15	2	0.1912
7	Perfluorododecanoic acid (PFDoA)	537 Rev 1.15	2	0.0916
8	Perfluorotridecanoic Acid (PRTrDA)	537 Rev 1.15	2	0.0904
9	Perfluorotetradecanoic acid (PFTA)	537 Rev 1.15	2	0.072
10	Perfluorobutanesulfonic acid (PFBS)	537 Rev 1.15	2	0.11
11	Perfluorohexanesulfonic acid (PFHxS)	537 Rev 1.15	2	0.1076
12	Perfluorooctanesulfonic acid (PFOS)	537 Rev 1.15	2	0.1116
13	Perfluorodecanesulfonic Acid (PFDS)	537 Rev 1.15	2	0.2224
14	Perfluorobutanoic Acid (PFBA)	537 Rev 1.15	2	0.1312
15	Perfluoropentanoic Acid (PFPeA)	537 Rev 1.15	2	0.0856
16	Perfluoroheptane Sulfonic Acid (PFHpS)	537 Rev 1.15	2	0.1552
17	1H,1H,2H,2H-Perfluorooctane Sulfonate (6:2 FTS)	537 Rev 1.15	2	0.194
18	1H,1H,2H,2H-Perfluorodecanesulfonic Acid (8:2 FTS)	537 Rev 1.15	2	0.2908
19	Perfluorooctanesulfonamide (FOSA)	537 Rev 1.15	2	0.2268
20	perfluorooctanesulfonamidoacetic acid (MeFOSAA)	537 Rev 1.15	2	0.2504
21	perfluorooctanesulfonamidoacetic acid (EtFOSAA)	537 Rev 1.15	2	0.3728

Notes:

1) RL = Reporting Limit

2) MDL = Method Detection Limit

3) RL and MDL values were supplied by Alpha Analytical Laboratories

4) RL and MDL values are estimated and may vary depending on instruments

5) μg/L = micrograms per liter
6) ng/L = nanograms per liter

		TABLE 7		
	PROJECT QUANTITATION LIMITS – AIR			
			Estimated Qua	idwater)
	Compound	Method	RL (ppbV)	MDL(ppbV)
	VOCs			
1	1,1,1-Trichloroethane	TO-15	0.2	0.057
2	1,1-Dichloroethene	TO-15	0.2	0.0566

		Estimated Quantitation Limits (Groundwater)		
	Compound	Method	RL (ppbV)	MDL(ppbV)
3	1,2,3-Trimethylbenzene	TO-15	0.2	0.0751
4	1,2,4-Trichlorobenzene	TO-15	0.2	0.0611
5	1,2,4-Trimethylbenzene	TO-15	0.2	0.0694
6	1,2,4,5-Tetramethylbenzene	TO-15	0.2	0.0795
7	1,2-Dibromoethane	TO-15	0.2	0.0779
8	1,2-Dichlorobenzene	TO-15	0.2	0.0614
9	1,2-Dichloroethane	TO-15	0.2	0.0552
10	1,2-Dichloropropane	TO-15	0.2	0.0697
11	1,3,5-Trimethylbenzene	TO-15	0.2	0.0584
12	1,3-Butadiene	TO-15	0.2	0.0799
13	1,3-Dichlorobenzene	TO-15	0.2	0.0637
14	1,4-Dichlorobenzene	TO-15	0.2	0.0418
15	1,4-Dioxane	TO-15	0.2	0.078
16	2,2,4-Trimethylpentane	TO-15	0.2	0.0659
17	2-Butanone	TO-15	0.5	0.0522
18	2-Hexanone	TO-15	0.2	0.0604
19	2-Methylthiophene	TO-15	0.2	0.0789
20	3-Methylthiophene	TO-15	0.2	0.0669
21	3-Chloropropene	TO-15	0.2	0.0812
22	2-Ethylthiophene	TO-15	0.2	0.0571
23	4-Ethyltoluene	TO-15	0.2	0.0776
24	Acetone	TO-15	1	0.269
25	Benzene	TO-15	0.2	0.0537
26	Benzyl chloride	TO-15	0.2	0.0645
27	Benzothiophene	TO-15	0.5	0.0468
28	Bromodichloromethane	TO-15	0.2	0.0656
29	Bromoform	TO-15	0.2	0.0523
30	Bromomethane	TO-15	0.2	0.0696
31	Carbon disulfide	TO-15	0.2	0.0345
32	Carbon tetrachloride	TO-15	0.2	0.0471
33	Chlorobenzene	TO-15	0.2	0.0789
34	Chloroethane	TO-15	0.2	0.0767
35	Chloroform	TO-15	0.2	0.0452
36	Chloromethane	TO-15	0.2	0.0958
37	cis-1,2-Dichloroethene	TO-15	0.2	0.0587
38	cis-1,3-Dichloropropene	TO-15	0.2	0.0745
39	Cyclohexane	TO-15	0.2	0.0656

TABLE 7 PROJECT QUANTITATION LIMITS – AIR

		Estimated Quantitation Limits (Groundwater)		
	Compound	Method	RL (ppbV)	MDL(ppbV)
40	Dibromochloromethane	TO-15	0.2	0.0747
41	Dichlorodifluoromethane	TO-15	0.2	0.0466
42	Ethyl Alcohol	TO-15	5	0.542
43	Ethyl Acetate	TO-15	0.5	0.131
44	Ethylbenzene	TO-15	0.2	0.0555
45	1,1,2-Trichloro-1,2,2- Trifluoroethane	TO-15	0.2	0.0511
46	1,2-Dichloro-1,1,2,2- tetrafluoroethane	TO-15	0.2	0.0419
47	Hexachlorobutadiene	TO-15	0.2	0.0732
48	iso-Propyl Alcohol	TO-15	0.5	0.114
49	Methylene chloride	TO-15	0.5	0.188
50	4-Methyl-2-pentanone	TO-15	0.5	0.0607
51	Methyl tert butyl ether	TO-15	0.2	0.0452
52	Methyl Methacrylate	TO-15	0.5	0.148
53	p/m-Xylene	TO-15	0.4	0.139
54	o-Xylene	TO-15	0.2	0.0631
55	Xylene (Total)	TO-15	0.2	0.0631
56	Heptane	TO-15	0.2	0.0553
57	n-Heptane	TO-15	0.2	0.0553
58	n-Hexane	TO-15	0.2	0.0518
59	Propylene	TO-15	0.5	0.0929
60	Styrene	TO-15	0.2	0.0799
61	Tetrachloroethene	TO-15	0.2	0.0758
62	Thiophene	TO-15	0.2	0.0528
63	Tetrahydrofuran	TO-15	0.5	0.0622
64	Toluene	TO-15	0.2	0.0628
65	trans-1,2-Dichloroethene	TO-15	0.2	0.074
66	1,2-Dichloroethene (total)	TO-15	0.2	0.0587
67	trans-1,3-Dichloropropene	TO-15	0.2	0.0693
68	1,3-Dichloropropene, Total	TO-15	0.2	0.0693
69	Trichloroethene	TO-15	0.2	0.071
70	Trichlorofluoromethane	TO-15	0.2	0.0416
71	Vinyl acetate	TO-15	1	0.0567
72	Vinyl bromide	TO-15	0.2	0.0699
73	Vinyl chloride	TO-15	0.2	0.0533
74	Naphthalene	TO-15	0.2	0.0432
75	Total HC As Hexane	TO-15	10	0.0518

 TABLE 7

 PROJECT QUANTITATION LIMITS – AIR

		Estimated Quantitation Limits (Groundwater)		
	Compound	Method	RL (ppbV)	MDL(ppbV)
76	Total VOCs As Toluene	TO-15	10	0.0628
77	Propane	TO-15	0.5	0.114
78	Acrylonitrile	TO-15	0.5	0.079
79	Acrolein	TO-15	0.5	0.114
80	1,1,1,2-Tetrachloroethane	TO-15	0.2	0.0547
81	lsopropylbenzene	TO-15	0.2	0.043
82	1,2,3-Trichloropropane	TO-15	0.2	0.0767
83	Acetonitrile	TO-15	0.2	0.0761
84	Bromobenzene	TO-15	0.2	0.079
85	Chlorodifluoromethane	TO-15	0.2	0.0626
86	Dichlorofluoromethane	TO-15	0.2	0.0572
87	Dibromomethane	TO-15	0.2	0.0476
88	Pentane	TO-15	0.2	0.0475
89	Octane	TO-15	0.2	0.0421
90	Tertiary-Amyl Methyl Ether	TO-15	0.2	0.0795
91	o-Chlorotoluene	TO-15	0.2	0.0487
92	p-Chlorotoluene	TO-15	0.2	0.0764
93	2,2-Dichloropropane	TO-15	0.2	0.0581
94	1,1-Dichloropropene	TO-15	0.2	0.0715
95	Isopropyl Ether	TO-15	0.2	0.0656
96	Ethyl-Tert-Butyl-Ether	TO-15	0.2	0.0515
97	1,2,3-Trichlorobenzene	TO-15	0.2	0.0436
98	Ethyl ether	TO-15	0.2	0.0591
99	n-Butylbenzene	TO-15	0.2	0.0639
100	sec-Butylbenzene	TO-15	0.2	0.0731
101	tert-Butylbenzene	TO-15	0.2	0.0402
102	1,2-Dibromo-3-chloropropane	TO-15	0.2	0.0744
103	p-lsopropyltoluene	TO-15	0.2	0.0608
104	n-Propylbenzene	TO-15	0.2	0.0559
105	1,3-Dichloropropane	TO-15	0.2	0.0776
106	Methanol	TO-15	5	0.736
107	Acetaldehyde	TO-15	2.5	0.547
108	Butane	TO-15	0.2	0.0442
109	Nonane (C9)	TO-15	0.2	0.0644
110	Decane (C10)	TO-15	0.2	0.0484
111	Undecane	TO-15	0.2	0.0528
112	Indane	TO-15	0.2	0.0795

TABLE 7 PROJECT QUANTITATION LIMITS – AIR

			Estimated Quantitation Limits (Groundwater)	
	Compound	Method	RL (ppbV)	MDL(ppbV)
113	Indene	TO-15	0.2	0.0608
114	1-Methylnaphthalene	TO-15	1	0.286
115	Dodecane (C12)	TO-15	0.2	0.0564
116	Butyl Acetate	TO-15	0.5	0.114
117	tert-Butyl Alcohol	TO-15	0.5	0.0599
118	2-Methylnaphthalene	TO-15	1	0.0273

TABLE 7
PROJECT QUANTITATION LIMITS – AIR

Notes:

1) RL = Reporting Limit

2)

MDL = Method Detection Limit RL and MDL values were supplied by Alpha Analytical Laboratories 3)

4) RL and MDL values are estimated and may vary depending on instrument

5) ppbV = parts per billion volume

8.0 DATA REDUCTION, VALIDATION, AND REPORTING

8.1 INTRODUCTION

Data collected during the field investigation will be reduced and reviewed by the laboratory QA personnel, and a report on the findings will be tabulated in a standard format. The criteria used to identify and quantify the analytes will be those specified for the applicable methods in the USEPA SW-846 and subsequent updates. The data package provided by the laboratory will contain all items specified in the USEPA SW-846 appropriate for the analyses to be performed, and be reported in standard format.

The completed copies of the chain-of-custody records (both external and internal) accompanying each sample from time of initial bottle preparation to completion of analysis shall be attached to the analytical reports.

8.2 DATA REDUCTION

The Analytical Services Protocol (ASP) Category B data packages and an electronic data deliverable (EDD) will be provided by the laboratory after receipt of a complete sample delivery group. The Project Manager will immediately arrange for archiving the results and preparation of result tables. These tables will form the database for assessment of the site contamination condition.

Each EDD deliverable must be formatted using a Microsoft Windows operating system and the NYSDEC data deliverable format for EQuIS. To avoid transcription errors, data will be loaded directly into the ASCII format from the laboratory information management system (LIMS). If this cannot be accomplished, the consultant should be notified via letter of transmittal indicating that manual entry of data is required for a particular method of analysis. All EDDs must also undergo a QC check by the laboratory before delivery. The original data, tabulations, and electronic media are stored in a secure and retrievable fashion.

The Project Manager will maintain close contact with the QA reviewer to ensure all nonconformance issues are acted upon prior to data manipulation and assessment routines. Once the QA review is completed, the Project Manager may direct others to initiate and finalize the analytical data assessment.

8.3 DATA VALIDATION

Data validation will be performed in accordance with the USEPA Region 2 SOPs for data validation and USEPA's National Functional Guidelines for Organic and Inorganic Data Review. Tier 1 data validation (the equivalent of USEPA's Stage 2A validation) will be performed to evaluate data quality. Tier 1 data validation is based on completeness and compliance checks of sample-related QC results including:

- Holding times;
- Sample preservation;
- Blank results (method, trip, and field blanks);
- Surrogate recovery compounds and extracted internal standards (as applicable);
- LCS and LCSD recoveries and RPDs;
- MS and MSD recoveries and RPDs;
- Laboratory duplicate RPDs; and
- Field duplicate RPDs

A DUSR will be prepared by the data validator and reviewed by the QAM before issuance. The DUSR will present the results of data validation, including a summary assessment of laboratory data packages, sample preservation and chain-of-custody procedures, and a summary assessment of precision, accuracy, representativeness, comparability, and completeness for each analytical method.

Based on the results of data validation, the validated analytical results reported by the laboratory will be assigned one of the following usability flags:

- "U" Not detected. The associated number indicates the approximate sample concentration necessary to be detected significantly greater than the level of the highest associated blank;
- "UJ" Not detected. Quantitation limit may be inaccurate or imprecise;
- "J" Analyte is present. Reported value may be associated with a higher level of uncertainty than is normally expected with the analytical method
- "R" Unreliable result; data is rejected or unusable. Analyte may or may not be present in the sample; and
- No Flag Result accepted without qualification.

9.0 INTERNAL QUALITY CONTROL CHECKS AND FREQUENCY

9.1 QUALITY ASSURANCE BATCHING

Each set of samples will be analyzed concurrently with calibration standards, method blanks, matrix spikes (MS), matrix spike duplicates (MSD) or laboratory duplicates, and QC check samples (if required by the protocol). The MS/MSD samples will be designated by the field personnel. If no MS/MSD samples were designated, the laboratory will contact the Langan Project Manager for corrective action.

9.2 CALIBRATION STANDARDS AND SURROGATES

All organic standard and surrogate compounds are checked by the method of mass spectrometry for correct identification and gas chromatography for degree of purity and concentration. All standards are traceable to a source of known quality certified by the USEPA or NIST, or other similar program. When the compounds pass the identity and purity tests, they are certified for use in standard and surrogate solutions. Concentrations of the solutions are checked for accuracy before release for laboratory use. Standard solutions are replaced monthly or more frequently, based upon data indicating deterioration.

9.3 ORGANIC BLANKS AND MATRIX SPIKE

Analysis of blank samples verifies that the analytical method does not introduce contaminants or detect "false positives." The blank water can be generated by reverse osmosis and Super-Q filtration systems, or distillation of water containing KMnO₄. The matrix spike is generated by addition of surrogate standard to each sample.

9.4 TRIP AND EQUIPMENT BLANKS

Trip blanks and equipment blanks will be utilized in accordance with the specifications in Section 4. These blanks will be analyzed to provide a check on sample bottle preparation and evaluate the effectiveness of field decontamination procedures.

10.0 QUALITY ASSURANCE PERFORMANCE AUDITS AND SYSTEM AUDITS

10.1 INTRODUCTION

Quality assurance audits may be performed by the project quality assurance group under the direction and approval of the QAO. These audits will be implemented to evaluate the capability and performance of project and subcontractor personnel, items, activities, and documentation of the measurement system(s). Functioning as an independent body and reporting directly to corporate quality assurance management, the QAO may plan, schedule, and approve system and performance audits based upon procedures customized to the project requirements. At times, the QAO may request additional personnel with specific expertise from company and/or project groups to assist in conducting performance audits. However, these personnel will not have responsibility for the project work associated with the performance audit.

10.2 SYSTEM AUDITS

System audits may be performed by the QAO or designated auditors, and encompass a qualitative evaluation of measurement system components to ascertain their appropriate selection and application. In addition, field and laboratory quality control procedures and associated documentation may be system audited. These audits may be performed once during the performance of the project. However, if conditions adverse to quality are detected or at the request of the Project Manager, additional audits may occur.

10.3 PERFORMANCE AUDITS

The laboratory may be required to conduct an analysis of Performance Evaluation samples or provide proof that Performance Evaluation samples submitted by the USEPA or a state agency were analyzed within the past twelve months.

10.4 FORMAL AUDITS

Formal audits refer to any system or performance audit that is documented and implemented by the QA group. These audits encompass documented activities performed by qualified lead auditors to a written procedure or checklists to objectively verify that quality assurance requirements were developed, documented, and instituted in accordance with contractual and project criteria. Formal audits may be performed on project and subcontractor work at various locations.

Audit reports will be written by auditors who have performed the site audit after gathering and evaluating all data. Items, activities, and documents determined by lead auditors to be in noncompliance shall be identified at exit interviews conducted with the involved management. Non-compliances will be logged, and documented through audit findings, which are attached to

and are a part of the integral audit report. These audit-finding forms are directed to management to satisfactorily resolve the noncompliance in a specified and timely manner.

The Project Manager has overall responsibility to ensure that all corrective actions necessary to resolve audit findings are acted upon promptly and satisfactorily. Audit reports must be submitted to the Project Manager within fifteen days of completion of the audit. Serious deficiencies will be reported to the Project Manager within 24 hours. All audit checklists, audit reports, audit findings, and acceptable resolutions will be reviewed and approved by the QAO. Verification of acceptable resolutions may be determined by re-audit or documented surveillance of the item or activity. Upon verification acceptance, the QAO will close out the audit report and findings.

11.0 PREVENTIVE MAINTENANCE PROCEDURES AND SCHEDULES

11.1 PREVENTIVE MAINTENANCE PROCEDURES

Equipment, instruments, tools, gauges, and other items requiring preventive maintenance will be serviced in accordance with the manufacturer's specified recommendations and written procedure developed by the operators.

A list of critical spare parts will be established by the operator. These spare parts will be available for use in order to reduce the downtime. A service contract for rapid instrument repair or backup instruments may be substituted for the spare part inventory.

11.2 SCHEDULES

Written procedures will establish the schedule for servicing critical items to minimize the downtime of the measurement system. Rental equipment subcontractors and the laboratory will adhere to the maintenance schedule, and arrange any necessary and prompt service. Required service will be performed by qualified personnel.

11.3 RECORDS

Logs shall be established to record and control maintenance and service procedures and schedules. All maintenance records will be documented and traceable to the specific equipment, instruments, tools, and gauges. Records produced shall be reviewed, maintained, and filed by the operators at the laboratories. The QAO may audit these records to verify complete adherence to these procedures.

12.0 CORRECTIVE ACTION

12.1 INTRODUCTION

The following procedures were established to ensure that conditions adverse to quality, such as malfunctions, deficiencies, deviations, and errors, are promptly investigated, documented, evaluated, and corrected.

12.2 PROCEDURE DESCRIPTION

When a significant condition adverse to quality is noted at site or laboratory, the cause of the condition will be determined and corrective action will be taken to preclude repetition. Condition identification, cause, reference documents, and corrective action planned to be taken will be documented and reported to the QAO, Project Manager, Field Team Leader and laboratory management, at a minimum. Implementation of corrective action is verified by documented follow-up action.

All project personnel have the responsibility, as part of the normal work duties, to promptly identify, solicit approved correction, and report conditions adverse to quality. Corrective actions will be initiated as follows:

- When predetermined acceptance standards are not attained;
- When procedure or data compiled are determined to be deficient;
- When equipment or instrumentation is found to be faulty;
- When samples and analytical test results are not clearly traceable;
- When quality assurance requirements have been violated;
- When designated approvals have been circumvented;
- As a result of system and performance audits;
- As a result of a management assessment;
- As a result of laboratory/field comparison studies; and
- As required by USEPA SW-846, and subsequent updates, or by the NYSDEC ASP.

Project management and staff, such as field investigation teams and laboratory groups, will monitor on-going work performance in the normal course of daily responsibilities. Work may be audited at the sites or laboratory. Activities ascertained to be noncompliant with quality assurance requirements will be documented. Corrective actions will be mandated through audit finding sheets attached to the audit report. Audit findings are logged, maintained, and controlled by the Project Manager.

Personnel assigned to quality assurance functions will have the responsibility to issue and control Corrective Action Request (CAR) Forms (Figure 12.1 or similar). The CAR identifies the out-of-compliance condition, reference document(s), and recommended corrective action(s) to be administered. The CAR is issued to the personnel responsible for the affected item or activity. A copy is also submitted to the Project Manager. The individual to whom the CAR is addressed returns the requested response promptly to the QA personnel, affixing his/her signature and date to the corrective action block, after stating the cause of the conditions and corrective action to be taken. The QA personnel maintain the log for status of CARs, confirms the adequacy of the intended corrective action, and verifies its implementation. CARs will be retained in the project file for the records.

Any project personnel may identify noncompliance issues; however, the designated QA personnel are responsible for documenting, numbering, logging, and verifying the close out action. The Project Manager will be responsible for ensuring that all recommended corrective actions are implemented, documented, and approved.

Figure 4: Corrective Action Request

CORRECTIVE ACTION REQUEST		
Number: Date:		
TO: You are hereby requested to take corrective actions indicated below and as otherwise determine by you to (a) resolve the noted condition and (b) to prevent it from recurring. Your written respons is to be returned to the project quality assurance manager by		
CONDITION:		
REFERENCE DOCUMENTS:		
RECOMMENDED CORRECTIVE ACTIONS:		
Originator Date Approval Date Approval Date		
RESPONSE		
CAUSE OF CONDITION		
CORRECTIVE ACTION		
(A) RESOLUTION		
(B) PREVENTION		
(C) AFFECTED DOCUMENTS		
C.A. FOLLOWUP:		
CORRECTIVE ACTION VERIFIED BY: DATE:		

13.0 REFERENCES

- NYSDEC. Division of Environmental Remediation. DER-10/Technical Guidance for Site Investigation and Remediation, dated May 3, 2010.
- Taylor, J. K., 1987. Quality Assurance of Chemical Measurements. Lewis Publishers, Inc., Chelsea, Michigan
- USEPA. Validating Volatile Organic Compounds By Gas Chromatography/Mass Spectrometry. SOP No. HW-24, Revision 4, dated October 2014. USEPA Region II.
- USEPA. Analysis of Volatile Organic Compounds in Air Contained in Canisters by Method TO-15. SOP No. HW-31, Revision 6, dated June 2014. USEPA Region II.
- USEPA. Polychlorinated Biphenyl (PCB) Aroclor Data Validation. SOP No. HW-37, Revision 3, dated May 2013. USEPA Region II.
- USEPA. Pesticide Data Validation. SOP No. HW-36, Revision 4, dated May 2013. USEPA Region II.
- USEPA. Semivolatile Data Validation. SOP No. HW-35, Revision 2, dated March 2013. USEPA Region II.
- USEPA. Tetro-through Octa-chlorinated Dioxins and Furans by Isotope Dilution (HRGC/HRMS). SOP For EPA Method 1613, Revision B, dated December 2010. USEPA Region II.
- USEPA. PCDDs/PCDFs using HRGC/HRMS. SOP for SW-846 Method 8290 HW-19, Revision 1.1, dated December 2010. USEPA Region II.
- USEPA, Polychlorinated Dibenzodioxins/Polychlorinated Dibenzofurans. SW-846 Method 8280 HW-11, Revision 3, dated December 2010. USEPA Region II.
- USEPA. Low/Medium Volatile Data Validation. SOP No. HW-33, Revision 3, dated March 2013. USEPA Region II.
- USEPA. ICP-AES Data Validation. SOP No. HW-2a, Revision 15, dated December 2012. USEPA Region II.
- USEPA. ICP-MS Data Validation. SOP No. HW-2b, Revision 15, dated December 2012. USEPA Region II.
- USEPA. Mercury and Cyanide Data Validation. SOP No. HW-2c, Revision 15, dated December 2012, USEPA Region II.
- USEPA. Trace Volatile Data Validation. SOP No. HW-34, Revision 3, dated February 2013, USEPA Region II.

ATTACHMENT A

PER- AND POLY-FLUOROALKYL SUBSTANCES SAMPLING PROTOCOL
Collection of Groundwater Samples for Perfluorooctanoic Acid (PFOA) and Perfluorinated Compounds (PFCs) from Monitoring Wells Sample Protocol

Samples collected using this protocol are intended to be analyzed for perfluorooctanoic acid (PFOA) and other perfluorinated compounds by Modified (Low Level) Test Method 537.

The procedure used must be consistent with the NYSDEC March 1991 Sampling Guidelines and Protocols_http://www.dec.ny.gov/docs/remediation_hudson_pdf/sgpsect5.pdf with the following materials limitations.

At this time acceptable materials for sampling include: stainless steel, high density polyethylene (HDPE), PVC, silicone, acetate and polypropylene. Equipment blanks should be generated at least daily. Additional materials may be acceptable if preapproved by NYSDEC. Requests to use alternate equipment should include clean equipment blanks. **NOTE: Grunfos pumps and bladder pumps are known to contain PFC materials (e.g. Teflon™ washers for Grunfos pumps and LDPE bladders for bladder pumps).** All sampling equipment components and sample containers should not come in contact with aluminum foil, low density polyethylene (LDPE), glass or polytetrafluoroethylene (PTFE, Teflon™) materials including sample bottle cap liners with a PTFE layer. Standard two step decontamination using detergent and clean water rinse will be performed for equipment that does come in contact with PFC materials. Clothing that contains PTFE material (including GORE-TEX®) or that have been waterproofed with PFC materials must be avoided. Many food and drink packaging materials and "plumbers thread seal tape" contain PFCs.

All clothing worn by sampling personnel must have been laundered multiple times. The sampler must wear nitrile gloves while filling and sealing the sample bottles.

Pre-cleaned sample bottles with closures, coolers, ice, sample labels and a chain of custody form will be provided by the laboratory.

- 1. Fill two pre-cleaned 500 mL HDPE or polypropylene bottle with the sample.
- 2. Cap the bottles with an acceptable cap and liner closure system.
- 3. Label the sample bottles.
- 4. Fill out the chain of custody.
- 5. Place in a cooler maintained at $4 \pm 2^{\circ}$ Celsius.

Collect one equipment blank for every sample batch, not to exceed 20 samples.

Collect one field duplicate for every sample batch, not to exceed 20 samples.

Collect one matrix spike / matrix spike duplicate (MS/MSD) for every sample batch, not to exceed 20 samples.

Request appropriate data deliverable (Category A or B) and an electronic data deliverable.

February 2018

<u>Issue:</u> NYSDEC has committed to analyzing representative groundwater samples at remediation sites for emerging contaminants (1,4-dioxane and PFAS) as described in the below guidance.

Implementation

NYSDEC project managers will be contacting site owners to schedule sampling for these chemicals. Only groundwater sampling is required. The number of samples required will be similar to the number of samples where "full TAL/TCL sampling" would typically be required in a remedial investigation. If sampling is not feasible (e.g., the site no longer has any monitoring wells in place), sampling may be waived on a site-specific basis after first considering potential sources of these chemicals and whether there are water supplies nearby.

Upon a new site being brought into any program (i.e., SSF, BCP), PFAS and 1,4-dioxane will be incorporated into the investigation of groundwater as part of the standard "full TAL/TCL" sampling. Until an SCO is established for PFAS, soil samples do not need to be analyzed for PFAS unless groundwater contamination is detected. Separate guidance will be developed to address sites where emerging contaminants are found in the groundwater. The analysis currently performed for SVOCs in soil is adequate for evaluation of 1,4-dioxane, which already has an established SCO.

Analysis and Reporting

Labs should provide a full category B deliverable, and a DUSR should be prepared by a data validator.

The work plan should explicitly describe analysis and reporting requirements.

<u>PFAS sample analysis</u>: Samples should be analyzed by an environmental laboratory certified by ELAP to use EPA method 537 or ISO 25101. ELAP does not currently offer certification for PFAS analysis of non-drinking water samples (including groundwater, soil and sediment), so there is no requirement to use an ELAP certified method. The preferred method is the modified EPA Method 537. Labs have been able to achieve reporting limits for PFOA and PFOS of 2 ng/l (part per trillion). If labs are not able to achieve similar reporting limits, the NYSDEC project manager will make case-by-case decisions as to whether the analysis can meet the needs for the specific site.

<u>PFAS sample reporting</u>: DER has developed a PFAS target analyte list (below) with the intent of achieving reporting consistency between labs for commonly reportable analytes. It is expected that reported results for PFAS will include, at a minimum, all the compounds listed. This list may be updated in the future as new information is learned and as labs develop new capabilities. If lab and/or matrix specific issues are encountered for any particular compounds, the NYSDEC project manager will make case-by-case decisions as to whether particular analytes may be temporarily or permanently discontinued from analysis for each site. Any technical lab issues should be brought to the attention of a NYSDEC chemist.

Some sampling using this full PFAS target analyte list is needed to understand the nature of contamination. It may also be critical to differentiate PFAS compounds associated with a site from other sources of these chemicals. Like routine refinements to parameter lists based on investigative findings, the full PFAS target analyte list may not be needed for all sampling intended to define the extent of

contamination. Project managers may approve a shorter analyte list (e.g., just the UCMR3 list) for some reporting on a case by case basis.

<u>1,4-Dioxane Analysis and Reporting:</u> The method detection limit (MDL) for 1,4-dioxane should be no higher than 0.28 μ g/l (ppb). ELAP offers certification for both EPA Methods 8260 and 8270. In order to get the appropriate detection limits, the lab would need to run either of these methods in "selective ion monitoring" (SIM) mode. DER is advising PMS to use 8270, since this method provides a more robust extraction procedure, uses a larger sample volume, and is less vulnerable to interference from chlorinated solvents (we acknowledge that 8260 has been shown to have a higher recovery in some studies).

Group	Chemical Name	Abbreviation	CAS Number
	Perfluorobutanesulfonic acid	PFBS	375-73-5
5 4	Perfluorohexanesulfonic acid	PFHxS	355-46-4
sulfonates	Perfluoroheptanesulfonic acid	PFHpS	375-92-8
	Perfluorooctanessulfonic acid	PFOS	1763-23-1
	Perfluorodecanesulfonic acid	PFDS	335-77-3
	Perfluorobutanoic acid	PFBA	375-22-4
	Perfluoropentanoic acid	PFPeA	2706-90-3
	Perfluorohexanoic acid	PFHxA	307-24-4
	Perfluoroheptanoic acid	PFHpA	375-85-9
Dorfluoroollad	Perfluorooctanoic acid	PFOA	335-67-1
carboxvlates	Perfluorononanoic acid	PFNA	375-95-1
,, ,	Perfluorodecanoic acid	PFDA	335-76-2
	Perfluoroundecanoic acid	PFUA/PFUdA	2058-94-8
	Perfluorododecanoic acid	PFDoA	307-55-1
	Perfluorotridecanoic acid	PFTriA/PFTrDA	72629-94-8
	Perfluorotetradecanoic acid	PFTA/PFTeDA	376-06-7
Fluorinated Telomer	6:2 Fluorotelomer sulfonate	6:2 FTS	27619-97-2
Sulfonates	8:2 Fluorotelomer sulfonate	8:2 FTS	39108-34-4
Perfluorooctane- sulfonamides	Perfluroroctanesulfonamide	FOSA	754-91-6
Perfluorooctane-	N-methyl perfluorooctanesulfonamidoacetic acid	N-MeFOSAA	2355-31-9
suifonamidoacetic acids	N-ethyl perfluorooctanesulfonamidoacetic acid	N-EtFOSAA	2991-50-6

Full PFAS Target Analyte List

Bold entries depict the 6 original UCMR3 chemicals

ATTACHMENT B

STANDARD OPERATING PROCEDURES FOR DETERMINATION OF PERFLUORINATED ALYKL SUBSTANCES

Determination of Selected Perfluorinated Alkyl Substances by Solid Phase Extraction and Liquid Chromatography/Tandem Mass Spectrometry Isotope Dilution (LC/MS/MS)

Reference: EPA Method 537, Version 1.1, September 2009, EPA Document #: EPA/600/R-08/09

EPA Method 537.1, Version 1, November 2018, EPA Document #: EPA/600/R-18/352

Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 5.2, .2019

1. Scope and Application

Matrices: Drinking water, Non-potable Water, and Soil Matrices

Definitions: Refer to Alpha Analytical Quality Manual.

- **1.1** This is a liquid chromatography/tandem mass spectrometry (LC/MS/MS) method for the determination of selected perfluorinated alkyl substances (PFAS) in Non-Drinking Water and soil Matrices. Accuracy and precision data have been generated in reagent water, and finished ground and surface waters for the compounds listed in Table 1.
- **1.2** The data report packages present the documentation of any method modification related to the samples tested. Depending upon the nature of the modification and the extent of intended use, the laboratory may be required to demonstrate that the modifications will produce equivalent results for the matrix. Approval of all method modifications is by one or more of the following laboratory personnel before performing the modification: Area Supervisor, Department Supervisor, Laboratory Director, or Quality Assurance Officer.
- **1.3** This method is restricted to use by or under the supervision of analysts experienced in the operation of the LC/MS/MS and in the interpretation of LC/MS/MS data. Each analyst must demonstrate the ability to generate acceptable results with this method by performing an initial demonstration of capability.

2. Summary of Method

2.1 A 250-mL water sample is fortified with extracted internal standards (EIS) and passed through a solid phase extraction (WAX) cartridge containing a mixed mode, Weak Anion Exchange, reversed phase, water-wettable polymer to extract the method analytes and isotopically-labeled compounds. The compounds are eluted from the solid phase in two fractions with methanol followed by a small amount of 2% ammonium hydroxide in methanol solution. The extract is concentrated with nitrogen in a heated water bath, and then adjusted to a 1-mL volume with 80:20% (vol/vol) methanol:water. A 3 µl injection is made into an LC equipped with a C18 column that is interfaced to an MS/MS. The analytes are separated and identified by comparing the acquired mass spectra and retention times to reference spectra and retention times for calibration standards acquired under identical LC/MS/MS conditions. The concentration of each analyte is determined by using the isotope dilution technique. Extracted Internal Standards (EIS) analytes are used to monitor the extraction efficiency of the method analytes.

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2.2 Method Modifications from Reference

None.

Table 1		
Parameter	Acronym	CAS
PERFLUOROALKYL ETHER CARBOXYLIC ACIDS	6 (PFECAs)	
Tetrafluoro-2-(heptafluoropropoxy)propanoic acid	HFPO-DA	62037-80-3
4,8-dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4
PERFLUOROALKYLCARBOXILIC ACIDS (PFCAs)		
Perfluorobutanoic acid	PFBA	375-22-4
Perfluoropentanoic acid	PFPeA	2706-90-3
Perfluorohexanoic acid	PFHxA *	307-24-4
Perfluoroheptanoic acid	PFHpA *	375-85-9
Perfluorooctanoic acid	PFOA *	335-67-1
Perfluorononanoic acid	PFNA *	375-95-1
Perfluorodecanoic acid	PFDA *	335-76-2
Perfluoroundecanoic acid	PFUnA *	2058-94-8
Perfluorododecanoic acid	PFDoA *	307-55-1
Perfluorotridecanoic acid	PFTrDA *	72629-94-8
Perfluorotetradecanoic acid	PFTA *	376-06-7
Perfluorohexadecanoic acid	PFHxDA	67905-19-5
Perfluorooctadecanoic acid	PFODA	16517-11-6
PERFLUOROALKYLSULFONATES (PFASs)		
Perfluorobutanesulfonic acid	PFBS *	375-73-5
Perfluoropentanesulfonic acid	PFPeS	2706-91-4
Perfluorohexanesulfonic acid	PFHxS *	355-46-4
Perfluoroheptanesulfonic acid	PFHpS	375-92-8
Perfluorooctanesulfonic acid	PFOS *	1763-23-1
Perfluorononanesulfonic acid	PFNS	68259-12-1
Perfluorodecanesulfonic acid	PFDS	335-77-3
Perfluorododecanesulfonic acid	PFDoS	79780-39-5

* also reportable via the standard 537 method

Table 1 Cont.

Parameter	Acronym	CAS					
CHLORO-PERFLUOROALKYLSULFONATE	fr						
11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11CI- PF3OUdS	763051-92-9					
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid	9CI-PF3ONS	756426-58-1					
PERFLUOROOCTANESULFONAMIDES (FOSAs)							
Perfluorooctanesulfonamide	PFOSA	754-91-6					
N-methylperfluoro-1-octanesulfonamide	NMeFOSA	31506-32-8					
N-ethylperfluoro-1-octanesulfonamide	NEtFOSA	4151-50-2					
TELOMER SULFONATES							
1H,1H,2H,2H-perfluorohexane sulfonate (4:2)	4:2FTS	27619-93-8					
1H,1H,2H,2H-perfluorooctane sulfonate (6:2)	6:2FTS	27619-97-2					
1H,1H,2H,2H-perfluorodecane sulfonate (8:2)	8:2FTS	39108-34-4					
1H,1H,2H,2H-perfluorododecane sulfonate (10:2)	10:2FTS	120226-60-0					
PERFLUOROOCTANESULFONAMIDOACETIC ACIDS							
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA *	2355-31-9					
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA *	2991-50-6					
NATIVE PERFLUOROOCTANESULFONAMIDOETHA	NOLS (FOSEs)	· · · · ·					
2-(N-methylperfluoro-1-octanesulfonamido)-ethanol	NMeFOSE	24448-09-7					
2-(N-ethylperfluoro-1-octanesulfonamido)-ethanol	NEtFOSE	1691-99-2					

* also reportable via the standard 537 method

3. Reporting Limits

The reporting limit for PFAS's is 2 ng/L for aqueous samples (20 ng/L for HFPO-DA) and 1 ng/g (10 ng/g for HFPO-DA) for soil samples.

4. Interferences

- **4.1** PFAS standards, extracts and samples should not come in contact with any glass containers or pipettes as these analytes can potentially adsorb to glass surfaces. PFAS analyte and EIS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers.
- **4.2** Method interferences may be caused by contaminants in solvents, reagents (including reagent water), sample bottles and caps, and other sample processing hardware that lead to discrete artifacts and/or elevated baselines in the chromatograms. The method analytes in this method can also be found in many common laboratory supplies and equipment, such

as PTFE (polytetrafluoroethylene) products, LC solvent lines, methanol, aluminum foil, SPE sample transfer lines, etc. All items such as these must be routinely demonstrated to be free from interferences (less than 1/3 the RL for each method analyte) under the conditions of the analysis by analyzing laboratory reagent blanks as described in Section 9.2. **Subtracting blank values from sample results is not permitted.**

- **4.3** Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the water. Humic and/or fulvic material can be co-extracted during SPE and high levels can cause enhancement and/or suppression in the electrospray ionization source or low recoveries on the SPE sorbent. Total organic carbon (TOC) is a good indicator of humic content of the sample.
- **4.4** SPE cartridges can be a source of interferences. The analysis of field and laboratory reagent blanks can provide important information regarding the presence or absence of such interferences. Brands and lots of SPE devices should be tested to ensure that contamination does not preclude analyte identification and quantitation.

5. Health and Safety

- **5.1** The toxicity or carcinogenicity of each reagent and standard used in this method is not fully established; however, each chemical compound should be treated as a potential health hazard. From this viewpoint, exposure to these chemicals must be reduced to the lowest possible level by whatever means available. A reference file of material safety data sheets is available to all personnel involved in the chemical analysis. Additional references to laboratory safety are available in the Chemical Hygiene Plan.
- **5.2** All personnel handling environmental samples known to contain or to have been in contact with municipal waste must follow safety practices for handling known disease causative agents.
- **5.3** PFOA has been described as "likely to be carcinogenic to humans." Pure standard materials and stock standard solutions of these method analytes should be handled with suitable protection to skin and eyes, and care should be taken not to breathe the vapors or ingest the materials.

6. Sample Collection, Preservation, Shipping and Handling

6.1 Sample Collection for Aqueous Samples

- **6.1.1** Samples must be collected in two (2) 250-mL high density polyethylene (HDPE) container with an unlined plastic screw cap.
- **6.1.2** The sample handler must wash their hands before sampling and wear nitrile gloves while filling and sealing the sample bottles. PFAS contamination during sampling can occur from a number of common sources, such as food packaging and certain foods and beverages. Proper hand washing and wearing nitrile gloves will aid in minimizing this type of accidental contamination of the samples.
- **6.1.3** Open the tap and allow the system to flush until the water temperature has stabilized (approximately 3 to 5 min). Collect samples from the flowing system.

- 6.1.4 Fill sample bottles. Samples do not need to be collected headspace free.
- **6.1.5** After collecting the sample and cap the bottle. Keep the sample sealed from time of collection until extraction.
- 6.1.6 Field Reagent Blank (FRB)
 - **6.1.6.1** A FRB must be handled along with each sample set. The sample set is composed of samples collected from the same sample site and at the same time. At the laboratory, fill the field blank sample bottle with reagent water and preservatives, seal, and ship to the sampling site along with the sample bottles. For each FRB shipped, an empty sample bottle (no preservatives) must also be shipped. At the sampling site, the sampler must open the shipped FRB and pour the reagent water into the empty shipped sample bottle, seal and label this bottle as the FRB. The FRB is shipped back to the laboratory along with the samples and analyzed to ensure that PFAS's were not introduced into the sample during sample collection/handling.

The reagent water used for the FRBs must be initially analyzed for method analytes as a MB and must meet the MB criteria in Section 9.2.1 prior to use. This requirement will ensure samples are not being discarded due to contaminated reagent water rather than contamination during sampling.

6.2 Sample Collection for Soil and Sediment samples.

Grab samples are collected in polypropylene containers. Sample containers and contact surfaces containing PTFE shall be avoided.

6.3 Sample Preservation

Not applicable.

6.4 Sample Shipping

Samples must be chilled during shipment and must not exceed 10 °C during the first 48 hours after collection. Sample temperature must be confirmed to be at or below 10 °C when the samples are received at the laboratory. Samples stored in the lab must be held at or below 6 °C until extraction, but should not be frozen.

NOTE: Samples that are significantly above 10° C, at the time of collection, may need to be iced or refrigerated for a period of time, in order to chill them prior to shipping. This will allow them to be shipped with sufficient ice to meet the above requirements.

6.5 Sample Handling

6.5.1 Holding Times

6.5.1.1 Water samples should be extracted as soon as possible but must be extracted within 14 days. Soil samples should be extracted within 28 days. Extracts are stored at < 10 ° C and analyzed within 28 days after extraction.

7. Equipment and Supplies

- **7.1** SAMPLE CONTAINERS 250-mL high density polyethylene (HDPE) bottles fitted with unlined screw caps. Sample bottles must be discarded after use.
- **7.2** POLYPROPYLENE BOTTLES 4-mL narrow-mouth polypropylene bottles.
- **7.3** CENTRIFUGE TUBES 50-mL conical polypropylene tubes with polypropylene screw caps for storing standard solutions and for collection of the extracts.
- **7.4** AUTOSAMPLER VIALS Polypropylene 0.7-mL autosampler vials with polypropylene caps.
 - **7.4.1** NOTE: Polypropylene vials and caps are necessary to prevent contamination of the sample from PTFE coated septa. However, polypropylene caps do not reseal, so evaporation occurs after injection. Thus, multiple injections from the same vial are not possible.
- **7.5** POLYPROPYLENE GRADUATED CYLINDERS Suggested sizes include 25, 50, 100 and 1000-mL cylinders.
- **7.6** Auto Pipets Suggested sizes include 5, 10, 25, 50, 100, 250, 500, 1000, 5000 and 10,000-µls.
- **7.7** PLASTIC PIPETS Polypropylene or polyethylene disposable pipets.
- **7.8** ANALYTICAL BALANCE Capable of weighing to the nearest 0.0001 g.

7.9 SOLID PHASE EXTRACTION (SPE) APPARATUS FOR USING CARTRIDGES

- **7.9.1** SPE CARTRIDGES 0.5 g SPE cartridges containing a reverse phase copolymer characterized by a weak anion exchanger (WAX) sorbent phase.
- **7.9.2** VACUUM EXTRACTION MANIFOLD A manual vacuum manifold with large volume sampler for cartridge extractions, or an automatic/robotic sample preparation system designed for use with SPE cartridges, may be used if all QC requirements discussed in Section 9 are met. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. Care must be taken with automated SPE systems to ensure the PTFE commonly used in these systems does not contribute to unacceptable analyte concentrations in the MB (Sect. 9.2.1).
- **7.9.3** SAMPLE DELIVERY SYSTEM Use of a polypropylene transfer tube system, which transfers the sample directly from the sample container to the SPE cartridge, is recommended, but not mandatory. Standard extraction manifolds come equipped with PTFE transfer tube systems. These can be replaced with 1/8" O.D. x 1/16" I.D. polypropylene or polyethylene tubing cut to an appropriate length to ensure no sample contamination from the sample transfer lines. Other types of non-PTFE tubing may be used provided it meets the MB (Sect. 9.2.1) and LCS (Sect. 9.3) QC requirements. The PTFE transfer tubes may be used, but an MB must be run on each PFTE transfer tube and the QC requirements in Section 13.2.2 must be met. In the case of automated SPE, the removal of PTFE lines may not be feasible; therefore, MBs will need to be rotated among the ports and must meet the QC requirements of Sections 13.2.2 and 9.2.1.
- 7.10 Extract Clean-up Cartridge 250 mg 6ml SPE Cartridge containing graphitized polymer carbon

- **7.11** EXTRACT CONCENTRATION SYSTEM Extracts are concentrated by evaporation with nitrogen using a water bath set no higher than 65 °C.
- **7.12** LABORATORY OR ASPIRATOR VACUUM SYSTEM Sufficient capacity to maintain a vacuum of approximately 10 to 15 inches of mercury for extraction cartridges.
- 7.13 LIQUID CHROMATOGRAPHY (LC)/TANDEM MASS SPECTROMETER (MS/MS) WITH DATA SYSTEM
 - **7.13.1** LC SYSTEM Instrument capable of reproducibly injecting up to 10-μL aliquots, and performing binary linear gradients at a constant flow rate near the flow rate used for development of this method (0.4 mL/min). The LC must be capable of pumping the water/methanol mobile phase without the use of a degasser which pulls vacuum on the mobile phase bottle (other types of degassers are acceptable). Degassers which pull vacuum on the mobile phase causing the analyte peaks to shift to earlier retention times over the course of the analysis batch. The usage of a column heater is optional.

NOTE: During the course of method development, it was discovered that while idle for more than one day, PFAS's built up in the PTFE solvent transfer lines. To prevent long delays in purging high levels of PFAS's from the LC solvent lines, they were replaced with PEEK tubing and the PTFE solvent frits were replaced with stainless steel frits. It is not possible to remove all PFAS background contamination, but these measures help to minimize their background levels.

- **7.13.2** LC/TANDEM MASS SPECTROMETER The LC/MS/MS must be capable of negative ion electrospray ionization (ESI) near the suggested LC flow rate of 0.4 mL/min. The system must be capable of performing MS/MS to produce unique product ions for the method analytes within specified retention time segments. A minimum of 10 scans across the chromatographic peak is required to ensure adequate precision.
- **7.13.3** DATA SYSTEM An interfaced data system is required to acquire, store, reduce, and output mass spectral data. The computer software should have the capability of processing stored LC/MS/MS data by recognizing an LC peak within any given retention time window. The software must allow integration of the ion abundance of any specific ion within specified time or scan number limits. The software must be able to calculate relative response factors, construct linear regressions or quadratic calibration curves, and calculate analyte concentrations.
- **7.13.4** ANALYTICAL COLUMN An LC BEH C₁₈ column (2.1 x 50 mm) packed with 1.7 μ m d_p C₁₈ solid phase particles was used. Any column that provides adequate resolution, peak shape, capacity, accuracy, and precision (Sect. 9) may be used.

8. Reagents and Standards

- **8.1** GASES, REAGENTS, AND SOLVENTS Reagent grade or better chemicals should be used.
 - **8.1.1** REAGENT WATER Purified water which does not contain any measurable quantities of any method analytes or interfering compounds greater than 1/3 the RL for each method analyte of interest. Prior to daily use, at least 3 L of reagent water should be flushed from the purification system to rinse out any build-up of analytes in the system's tubing.

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- **8.1.2** METHANOL (CH₃OH, CAS#: 67-56-1) High purity, demonstrated to be free of analytes and interferences.
- **8.1.3** AMMONIUM ACETATE ($NH_4C_2H_3O_2$, CAS#: 631-61-8) High purity, demonstrated to be free of analytes and interferences.
- **8.1.4** ACETIC ACID (H₃CCOOH, CAS#: 64-19-7) High purity, demonstrated to be free of analytes and interferences.
- **8.1.5** 1M AMMONIUM ACETATE/REAGENT WATER High purity, demonstrated to be free of analytes and interferences.
- 8.1.6 2mM AMMONIUM ACETATE/METHANOL:WATER (5:95) To prepare, mix 2 ml of 1M AMMONIUM ACETATE,1 ml ACETIC ACID and 50 ml METHANOL into I Liter of REAGENT WATER.
- **8.1.7** Methanol/Water (80:20) To prepare a 1 Liter bottle, mix 200 ml of REAGENT WATER with 800 ml of METHANOL.
- **8.1.8** AMMONIUM HYDROXIDE (NH₃, CAS#: 1336-21-6) High purity, demonstrated to be free of analytes and interferences.
- **8.1.9** Sodium Acetate (NaOOCCH₃, CAS#: 127-09-3) High purity, demonstrated to be free of analytes and interferences.
- **8.1.10** 25 mM Sodium Acetate Buffer To prepare 250mls, dissolve .625 grams of sodium acetate into 100 mls of reagent water. Add 4 mls Acetic Acid and adjust the final volume to 250 mls with reagent water.
- **8.1.11** NITROGEN Used for the following purposes: Nitrogen aids in aerosol generation of the ESI liquid spray and is used as collision gas in some MS/MS instruments. The nitrogen used should meet or exceed instrument manufacturer's specifications. In addition, Nitrogen is used to concentrate sample extracts (Ultra High Purity or equivalent).
- **8.1.12** ARGON Used as collision gas in MS/MS instruments. Argon should meet or exceed instrument manufacturer's specifications. Nitrogen gas may be used as the collision gas provided sufficient sensitivity (product ion formation) is achieved.
- **8.2** STANDARD SOLUTIONS When a compound purity is assayed to be 96% or greater, the weight can be used without correction to calculate the concentration of the stock standard. PFAS analyte and IS standards commercially purchased in glass ampoules are acceptable; however, all subsequent transfers or dilutions performed by the analyst must be prepared and stored in polypropylene containers. Standards for sample fortification generally should be prepared in the smallest volume that can be accurately measured to minimize the addition of excess organic solvent to aqueous samples.

NOTE: Stock standards and diluted stock standards are stored at ≤4 °C.

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- 8.2.1 ISOTOPE DILUTION Extracted Internal Standard (ID EIS) STOCK SOLUTIONS
 ID EIS stock standard solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.
- 8.2.2 ISOTOPE DILUTION Extracted Internal Standard PRIMARY DILUTION STANDARD (ID EIS PDS) – Prepare the ID EIS PDS at a concentration of 500 ng/mL. The ID PDS is prepared in 80:20% (vol/vol) methanol:water. The ID PDS is stable for 6 months when stored at ≤4 °C.

Isotope Labeled Standard	Conc. of EIS Stock (ng/mL)	Vol. of EIS Stock (mL)	Final Vol. of EIS PDS (mL)	Final Conc. of EIS PDS (ng/mL)
M4PFBA	1000	1.0	2.0	500
M5PFPeA	1000	1.0	2.0	500
M5PFHxA	1000	1.0	2.0	500
M4PFHpA	1000	1.0	2.0	500
M8PFOA	1000	1.0	2.0	500
M9PFNA	1000	1.0	2.0	500
M6PFDA	1000	1.0	2.0	500
M7PFUdA	1000	1.0	2.0	500
MPFDoA	1000	1.0	2.0	500
M2PFTeDA	1000	1.0	2.0	500
M2PFHxDA	50,000	.02	2.0	500
d3-N-MeFOSA	50,000	.02	2.0	500
d5-N-EtFOSA	50,000	.02	2.0	500
d7-N-MeFOSE	50,000	.02	2.0	500
d9-N-EtFOSE	50,000	.02	2.0	500
M8FOSA	1000	1.0	2.0	500
d3-N-MeFOSAA	1000	1.0	2.0	500
d5-N-EtFOSAA	1000	1.0	2.0	500
M3PFBS	929	1.0	2.0	464.5
M3PFHxS	946	1.0	2.0	473
M8PFOS	957	1.0	2.0	478.5
M2-4:2FTS	935	1.0	2.0	467.5
M2-6:2FTS	949	1.0	2.0	474.5
M2-8:2FTS	958	1.0	2.0	479
M3HFPO-DA	50,000	.4	2.0	10,000

Table 2

- **8.2.3** ANALYTE STOCK STANDARD SOLUTION Analyte stock standards are stable for at least 6 months when stored at 4 °C. When using these stock standards to prepare a PDS, care must be taken to ensure that these standards are at room temperature and adequately vortexed.
- **8.2.4** Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only. ANALYTE PRIMARY SPIKING STANDARD Prepare the spiking standard at a concentration of 500 ng/mL in methanol. The spiking standard is stable for at least two months when stored in polypropylene centrifuge tubes at room temperature.

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Table 3						
Analyte	Conc. of IS Stock (ng/mL)	Vol. of IS Stock (mL)	Final Vol. of IS PDS (mL)	Final Conc. of IS PDS (ng/mL)		
PFBA	2000	1	4	500		
PFPeA	2000	1	4	500		
PFHxA	2000	1	4	500		
PFHpA	2000	1	4	500		
PFOA	2000	1	4	500		
PFNA	2000	1	4	500		
PFDA	2000	1	4	500		
PFUdA	2000	1	4	500		
PFDoA	2000	1	4	500		
PFTrDA	2000	1	4	500		
PFTeDA	2000	1	4	500		
FOSA	2000	1	4	500		
N-MeFOSAA	2000	1	4	500		
N-EtFOSAA	2000	1	4	500		
L-PFBS	1770	1	4	442.5		
L-PFPeS	1880	1	4	470		
L-PFHxSK	1480	1	4	370		
Br-PFHxSK	344	1	4	86		
L-PFHpS	1900	1	4	475		
L-PFOSK	1460	1	4	365		
Br-PFOSK	391	1	4	97 75		
L-PFNS	1920	1	4	480		
L-PFDS	1930	1	4	482.5		
4:2FTS	1870	1	4	467.5		
6:2FTS	1900	1	4	475		
8:2FTS	1920	1	4	480		

8.2.5 Analyte Secondary Spiking Standard Prepare the spiking solution of additional add on components for project specific requirements only.

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Analyte	Conc. of IS	Vol. of IS Stock	Final Vol. of IS PDS	Final Conc. of IS
	Stock (ng/mL)	(mL)	(mL)	PDS (ng/mL)
ADONA	2000	1	4	500
PFHxDA	2000	1	4	500
PFODA	2000	1	4	500
HFPO-DA	100,000	.4	4	10,000
9CIPF3ONS	50,000	0.04	4	500
11CIPF3OUdS	50,000	0.04	4	500

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- 8.2.6 LOW, MEDIUM AND HIGH LEVEL LCS The LCS's will be prepared at the following concentrations and rotated per batch; 2 ng/L, 40 ng/L, 500 ng/l for drinking waters. The analyte PDS contains all the method analytes of interest at various concentrations in methanol. The analyte PDS has been shown to be stable for six months when stored at ≤4 °C.
- **8.2.7** Isotope Dilution Labeled Recovery Stock Solutions (ID REC) ID REC Stock solutions are stable for at least 6 months when stored at 4 °C. The stock solution is purchased at a concentration of 1000 ng/mL.
- **8.2.8** Isotope Dilution Labeled Recovery Primary Dilution Standard (ID REC PDS) Prepare the ID REC PDS at a concentration of 500 ng/mL. The ID REC PDS is prepared in 80:20% (vol/vol) methanol:water. The ID REC PDS is stable for at least six months when stored in polypropylene centrifuge tubes at ≤4 °C.

Analyte	Conc. of REC Stock (ng/mL)	Vol. of REC Stock (mL)	Final Vol. of REC PDS (mL)	Final Conc. of REC PDS (ng/mL)
M2PFOA	2000	1	4	500
M2PFDA	2000	1	4	500
M3PFBA	2000	1	4	500
M4PFOS	2000	1	4	500

Table 5

8.2.9 CALIBRATION STANDARDS (CAL) -

Current Concentrations (ng/mL): 0.5, 1.0, 5.0, 10.0, 50.0, 125, 150, 250, 500

Prepare the CAL standards over the concentration range of interest from dilutions of the analyte PDS in methanol containing 20% reagent water. 20 µl of the EIS PDS and REC PDS are added to the CAL standards to give a constant concentration of 10 ng/ml. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity. The CAL standards may also be used as CCVs (Sect. 9.8). To make calibration stock standards:

Table 6

Calibration Standard Concentration	Final Aqueous Cal STD Level Concentration	Final Soil Cal STD Level Concentration	24 compound stock added (ul)	PFHxDA Stock added (ul)	500 ng/ml PFHxDA dilution added (ul)	PFODA Stock added (ul)	500 ng/ml PFODA dilution added (ul)	ADONA, HFPO-DA, 11CI- PF3OUdS, 9CI- PF3ONS Stock added (ul)	500 ng/ml ADONA dilution added (ul)	Final Volume in MeOH/H₂O (82:20)
.5 ng/ml	2 ng/L	.25 ng/g	6.25		25		25		25	25 mls
1 ng/ml	4 ng/L	.5 ng/g	5		20		20		20	10 mls
5 ng/ml	20 ng/L	1 ng/g	25		100		100		100	10 mls
10 ng/ml	40 ng/L	5 ng/g	125	5		5		5		25 mls

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50 ng/ml	200 ng/L	25 ng/g	250	10	10	10	10 mls
125 ng/ml	500 ng/L	62.5 ng/g	625	25	25	25	10 mls
150 ng/ml	600 ng/L	75 ng/g	750	30	30	- 30	10 mls
250 ng/ml	1000 ng/L	125 ng/g	625				5 mls
500 ng/ml	2000 ng/L	250 ng/g	1250				5 mls

9. Quality Control

The laboratory must maintain records to document the quality of data that is generated. Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method.

9.1 MINIMUM REPORTING LIMIT (MRL) CONFIRMATION

9.1.1 Fortify, extract, and analyze seven replicate LCSs at 2 ng/l. Calculate the mean measured concentration (*Mean*) and standard deviation for these replicates. Determine the Half Range for the prediction interval of results (HR_{PIR}) using the equation below

$$HR_{PIR} = 3.963s$$

Where:

s = the standard deviation 3.963 = a constant value for seven replicates.

9.1.2 Confirm that the upper and lower limits for the Prediction Interval of Result ($PIR = Mean \pm HR_{PIR}$) meet the upper and lower recovery limits as shown below

The Upper PIR Limit must be ≤150% recovery.

 $\frac{Mean + HR_{PIR}}{Fortified Concentration} \times 100\% \le 150\%$

The Lower PIR Limit must be \geq 50% recovery.

<u>Mean – HR PIR</u> x 100% \ge 50% Fortified Concentration

9.1.3 The RL is validated if both the Upper and Lower PIR Limits meet the criteria described above. If these criteria are not met, the RL has been set too low and must be determined again at a higher concentration.

9.2 Blank(s)

9.2.1 METHOD BLANK (MB) - A Method Blank (MB) is required with each extraction batch to confirm that potential background contaminants are not interfering with the identification or quantitation of method analytes. Prep and analyze a MB for every 20 samples. If the MB produces a peak within the retention time window of any analyte that would prevent the determination of that analyte, determine the source of contamination and eliminate the interference before processing samples. Background contamination must be reduced to an acceptable level before proceeding. Background from method analytes or other contaminants that

interfere with the measurement of method analytes must be below the RL. If the method analytes are detected in the MB at concentrations equal to or greater than this level, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch. Because background contamination is a significant problem for several method analytes, it is highly recommended that the analyst maintain a historical record of MB data.

9.2.2 FIELD REAGENT BLANK (FRB) - The purpose of the FRB is to ensure that PFAS's measured in the Field Samples were not inadvertently introduced into the sample during sample collection/handling. Analysis of the FRB is required only if a Field Sample contains a method analyte or analytes at or above the RL. The FRB is processed, extracted and analyzed in exactly the same manner as a Field Sample.

9.3 Laboratory Control Sample (LCS) and Laboratory Control Sample Duplicates (LCSD)

9.3.1 An LCS is required with each extraction batch. The fortified concentration of the LCS may be rotated between low, medium, and high concentrations from batch to batch. Default limits of 50-150% of the true value may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. Calculate the percent recovery (% R) for each analyte using the equation

Where:

- A = measured concentration in the fortified sample B =fortification concentration.
- **9.3.2** Where applicable, LCSD's are to be extracted and analyzed. The concentration and analyte recovery criteria for the LCSD must be the same as the batch LCS The RSD's must fall within ≤30% of the true value for medium and high level replicates, and ≤50% for low level replicates. Calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = |LCS - LCSD| \times 100$$
$$(LCS + LCSD) / 2$$

9.3.3 If the LCS and or LCSD results do not meet these criteria for method analytes, then all data for the problem analyte(s) must be considered invalid for all samples in the extraction batch.

9.4 Labeled Recovery Standards (REC)

The analyst must monitor the peak areas of the REC(s) in all injections during each analysis day. **9.5** Extracted Internal Standards (EIS)

9.5.1 The EIS standard is fortified into all samples, CCVs, MBs, LCSs, MSs, MSDs, FD, and FRB prior to extraction. It is also added to the CAL standards. The EIS is a means of assessing method performance from extraction to final

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chromatographic measurement. Calculate the recovery (%R) for the EIS using the following equation

Where:

A = calculated EIS concentration for the QC or Field Sample B = fortified concentration of the EIS.

9.5.2 Default limits of 50-150% may be used for analytes until sufficient replicates have been analyzed to generate proper control limits. A low or high percent recovery for a sample, blank, or CCV does not require discarding the analytical data but it may indicate a potential problem with future analytical data. When EIS recovery from a sample, blank, or CCV are outside control limits, check 1) calculations to locate possible errors, 2) standard solutions for degradation, 3) contamination, and 4) instrument performance. For CCVs and QC elements spiked with all target analytes, if the recovery of the corresponding target analytes meet the acceptance criteria for the EIS in question, the data can be used but all potential biases in the recovery of the EIS must be documented in the sample report. If the associated target analytes do not meet the acceptance criteria, the data must be reanalyzed.

9.6 Matrix Spike (MS)

- **9.6.1** Analysis of an MS is required in each extraction batch and is used to determine that the sample matrix does not adversely affect method accuracy. Assessment of method precision is accomplished by analysis of a Field Duplicate (FD) (Sect. 9.6); however, infrequent occurrence of method analytes would hinder this assessment. If the occurrence of method analytes in the samples is infrequent, or if historical trends are unavailable, a second MS, or MSD, must be prepared, extracted, and analyzed from a duplicate of the Field Sample. Extraction batches that contain MSDs will not require the extraction of a field sample duplicate. If a variety of different sample matrices are analyzed regularly, for example, drinking water from groundwater and surface water sources, method performance should be established for each. Over time, MS data should be documented by the laboratory for all routine sample sources.
- **9.6.2** Within each extraction batch, a minimum of one Field Sample is fortified as an MS for every 20 Field Samples analyzed. The MS is prepared by spiking a sample with an appropriate amount of the Analyte Stock Standard (Sect. 8.2.3). Use historical data and rotate through the low, mid and high concentrations when selecting a fortifying concentration. Calculate the percent recovery (%*R*) for each analyte using the equation

Where:

A = measured concentration in the fortified sample

B = measured concentration in the unfortified sample

C = fortification concentration.

9.6.3 Analyte recoveries may exhibit matrix bias. For samples fortified at or above their native concentration, recoveries should range between 50-150%. If the accuracy of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCS, the recovery is judged to be

matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.7 Laboratory Duplicate

- **9.7.1** FIELD DUPLICATE OR LABORATORY FORTIFIED SAMPLE MATRIX DUPLICATE (FD or MSD) Within each extraction batch (not to exceed 20 Field Samples), a minimum of one FD or MSD must be analyzed. Duplicates check the precision associated with sample collection, preservation, storage, and laboratory procedures. If method analytes are not routinely observed in Field Samples, an MSD should be analyzed rather than an FD.
- **9.7.2** Calculate the relative percent difference (*RPD*) for duplicate measurements (*FD1* and *FD2*) using the equation

$$RPD = |FD1 - FD2| \times 100$$
(FD1 + FD2) / 2

- **9.7.3** RPDs for FDs should be ≤30%. Greater variability may be observed when FDs have analyte concentrations that are within a factor of 2 of the RL. At these concentrations, FDs should have RPDs that are ≤50%. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the CCV, the recovery is judged to be matrix biased. The result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.
- **9.7.4** If an MSD is analyzed instead of a FD, calculate the relative percent difference (RPD) for duplicate MSs (MS and MSD) using the equation

$$RPD = |MS - MSD| \times 100$$

$$(MS + MSD) / 2$$

9.7.5 RPDs for duplicate MSs should be ≤30% for samples fortified at or above their native concentration. Greater variability may be observed when MSs are fortified at analyte concentrations that are within a factor of 2 of the RL. MSs fortified at these concentrations should have RPDs that are ≤50% for samples fortified at or above their native concentration. If the RPD of any analyte falls outside the designated range, and the laboratory performance for that analyte is shown to be in control in the LCSD where applicable, the result is judged to be matrix biased. If no LCSD is present, the associated MS and MSD are to be re-analyzed to determine if any analytical has occurred. If the resulting RPDs are still outside control limits, the result for that analyte in the unfortified sample is labeled suspect/matrix to inform the data user that the results are suspect due to matrix effects.

9.8 Initial Calibration Verification (ICV)

9.8.1 As part of the IDC (Sect. 13.2), and after each ICAL, analyze a QCS sample from a source different from the source of the CAL standards. If a second vendor is not available, then a different lot of the standard should be used. The QCS should be prepared and analyzed just like a CCV. Acceptance criteria for the QCS are identical to the CCVs; the calculated amount for each analyte must be ±

Printouts of this document may be out of date and should be considered uncontrolled. To accomplish work, the published version of the document should be viewed online. Document Type: SOP-Technical Pre-Qualtrax Document ID: N/A 30% of the expected value. If measured analyte concentrations are not of acceptable accuracy, check the entire analytical procedureto locate and correct the problem.

9.9 Continuing Calibration Verification (CCV)

9.9.1 CCV Standards are analyzed at the beginning of each analysis batch, after every 10 Field Samples, and at the end of the analysis batch. See Section 10.7 for concentration requirements and acceptance criteria.

9.10 Method-specific Quality Control Samples

9.10.1 PEAK ASYMMETRY FACTOR – A peak asymmetry factor must be calculated using the equation below during the IDL and every time a calibration curve is generated. The peak asymmetry factor for the first two eluting peaks in a midlevel CAL standard (if only two analytes are being analyzed, both must be evaluated) must fall in the range of 0.8 to 1.5. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.



Where:

A_s = peak asymmetry factor .

 $A_s = b/a$

- *b* = width of the back half of the peak measured (at 10% peak height) from the trailing edge of the peak to a line dropped perpendicularly from the peak apex
- a = the width of the front half of the peak measured (at 10% peak height) from the leading edge of the peak to a line dropped perpendicularly from the apex.

9.11 Method Sequence

- CCV-LOW
- MB
- LCS
- LCSD
- MS
- Duplicate or MSD
- Field Samples (1-10)
- CCV-MID
- Field Samples (11-20)
- CCV-LOW

10. Procedure

10.1 Equipment Set-up

- **10.1.1** This procedure may be performed manually or in an automated mode using a robotic or automatic sample preparation device. If an automated system is used to prepare samples, follow the manufacturer's operating instructions, but all extraction and elution steps must be the same as in the manual procedure. Extraction and/or elution steps may not be changed or omitted to accommodate the use of an automated system. If an automated system is used, the MBs should be rotated among the ports to ensure that all the valves and tubing meet the MB requirements (Sect. 9.2).
- **10.1.2** Some of the PFAS's adsorb to surfaces, including polypropylene. Therefore, the aqueous sample bottles must be rinsed with the elution solvent (Sect 10.3.4) whether extractions are performed manually or by automation. The bottle rinse is passed through the cartridge to elute the method analytes and is then collected (Sect. 10.3.4).
- **10.1.3 NOTE:** The SPE cartridges and sample bottles described in this section are designed as single use items and should be discarded after use. They may not be refurbished for reuse in subsequent analyses.

10.2 Sample Preparation and Extraction of Aqueous Samples

10.2.1 Samples are preserved, collected and stored as presented in Section 6.

The entire sample that is received must be sent through the SPE cartridge. In addition, the bottle must be solvent rinsed and this rinse must be sent through the SPE cartridge as well. The method blank (MB) and laboratory control sample (LCS) must be extracted in exactly the same manner (i.e., must include the bottle solvent rinse). It should be noted that a water rinse alone is not sufficient. This does not apply to samples with high concentrations of PFAS that are prepared using serial dilution and not SPE.

10.2.2 Determine sample volume. Weigh all samples to the nearest 1g. If visible sediment is present, centrifuge and decant into a new 250mL HDPE bottle and record the weight of the new container.

NOTE: Some of the PFAS's adsorb to surfaces, thus the sample volume may **NOT** be transferred to a graduated cylinder for volume measurement.

- **10.2.3** The MB, LCS and FRB may be prepared by measuring 250 mL of reagent water with a polypropylene graduated cylinder or filling a 250-mL sample bottle to near the top.
- **10.2.4** Adjust the QC and sample pH to 3 by adding acetic acid in water dropwise
- **10.2.5** Add 20 μL of the EIS PDS (Sect. 8.2.2) to each sample and QC, cap and invert to mix.
- **10.2.6** If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.

10.3 Cartridge SPE Procedure

- **10.3.1** CARTRIDGE CLEAN-UP AND CONDITIONING DO NOT allow cartridge packing material to go dry during any of the conditioning steps. Rinse each cartridge with 3 X 5 mL of 2% ammonium hydroxide in methanol, followed by 5mls of methanol. Next, rinse each cartridge with 5 mls of the 25 mM acetate buffer, followed by 15 mL of reagent water, without allowing the water to drop below the top edge of the packing. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Add 4-5 mL of reagent water to each cartridge, attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.
- **10.3.2** SAMPLE EXTRACTON Adjust the vacuum so that the approximate flow rate is approximately 4 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.
- 10.3.3 SAMPLE BOTTLE AND CARTRIDGE RINSE After the entire sample has passed through the cartridge, rinse the sample bottles with 4 ml reagent water followed by 4 ml 25 mM acetate buffer at pH 4 and draw the aliquot through the sample transfer tubes and the cartridges. Draw air or nitrogen through the cartridge for 5-10 min at high vacuum (10-15 in. Hg). NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the entire sample has passed through the cartridge, the reservoirs must be rinsed to waste with reagent water.
- **10.3.4** SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 1 Turn off and release the vacuum. Lift the extraction manifold top and insert a rack with collection tubes into the extraction tank to collect the extracts as they are eluted from the cartridges. Rinse the sample bottles with 12 mls of methanol and draw the aliquot through the sample transfer tubes and cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

SAMPLE BOTTLE AND CARTRIDGE ELUTION, Fraction 2 In a separate collection vial, rinse the sample bottles with 12 mL of 2% ammonium hydroxide in methanol and elute the analytes from the cartridges by pulling the 4 mL of methanol through the sample transfer tubes and the cartridges. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion. To the final extract, add 50 ul of acetic acid.

NOTE: If empty plastic reservoirs are used in place of the sample transfer tubes to pass the samples through the cartridges, these reservoirs must be treated like the transfer tubes. After the reservoirs have been rinsed in Section 10.3.3, the elution solvent used to rinse the sample bottles must be swirled down the sides of the reservoirs while eluting the cartridge to ensure that any method analytes on the surface of the reservoirs are transferred to the extract.

CLEAN-UP CARTRIDGE ELUTION, Elute the clean-up cartridge with 8 additional mls of methanol and draw the aliquot through the cartridge. Use a low vacuum such that the solvent exits the cartridge in a dropwise fashion.

10.3.5 Fractions 1 and 2 are to be combined during the concentration stage (section10.6)

10.4 Sample Prep and Extraction Protocol for Soils

- **10.4.1** Homogenize and weigh 2 grams of sample (measured to the nearest hundredth of a gram) into a 50 ml polypropylene centrifuge tube. For laboratory control blanks and spikes, 2 grams of clean sand is used.
- 10.4.2 Add 20 µL of the EIS PDS (Sect. 8.2.2) to each sample and QC.
- **10.4.3** If the sample is an LCS, LCSD, MS, or MSD, add the necessary amount of analyte PDS (Sect. 8.2.3). Cap and invert each sample to mix.
- **10.4.4** To all samples, add 10 mls of methanol, cap, vortex for 25 seconds at 3000RPM and mix for 30 minutes using a shaker table of tumbler at 120RPM.
- **10.4.5** Following mixing, sonicate each sample for 30 minutes and let samples sit overnight (at least 2 hours is required for RUSH samples).
- **10.4.6** Centrifuge each sample at 3500RPM for 10 minutes.
- **10.4.7** Remove supernatant, and reserve for clean-up.

10.5 Extract Clean-up

- **10.5.1** CARTRIDGE CLEAN-UP AND CONDITIONING –. Rinse each cartridge with 15 mL of methanol and discard. If the cartridge goes dry during the conditioning phase, the conditioning must be started over. Attach the sample transfer tubes (Sect. 7.9.3), turn on the vacuum, and begin adding sample to the cartridge.
- **10.5.2** Adjust the vacuum so that the approximate flow rate is 1-2 mL/min. Do not allow the cartridge to go dry before all the sample has passed through.
- **10.5.3** SAMPLE BOTTLE AND CARTRIDGE RINSE After the entire sample has passed through the cartridge, rinse the sample collection vial with two 1-mL aliquots of methanol and draw each aliquot through the cartridges. Draw air or nitrogen through the cartridge for 5 min at high vacuum (10-15 in. Hg).
- **10.5.4** If extracts are not to be immediately evaporated, cover collection tubes and store at ambient temperature till concentration.

10.6 Extract Concentration

10.6.1 Concentrate the extract to dryness under a gentle stream of nitrogen in a heated water bath (60-65 °C) to remove all the water/methanol mix. Add the appropriate amount of 80:20% (vol/vol) methanol:water solution and 20 μl of the ID REC PDS (Sect. 8.2.7) to the collection vial to bring the volume to 1 mL and vortex. Transfer two aliquots with a plastic pipet (Sect. 7.6) into 2 polypropylene autosampler vials.

NOTE: It is recommended that the entire 1-mL aliquot not be transferred to the autosampler vial because the polypropylene autosampler caps do not reseal after injection. Therefore, do not store the extracts in the autosampler vials as evaporation losses can occur occasionally in these autosampler vials. Extracts can be split between 2 X 700 µl vials (Sect. 7.4).

10.7 Sample Volume Determination

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- **10.7.1** If the level of the sample was marked on the sample bottle, use a graduated cylinder to measure the volume of water required to fill the original sample bottle to the mark made prior to extraction. Determine to the nearest 10 mL.
- **10.7.2** If using weight to determine volume, weigh the empty bottle to the nearest 10 g and determine the sample weight by subtraction of the empty bottle weight from the original sample weight (Sect. 10.2.2). Assume a sample density of 1.0 g/mL. In either case, the sample volume will be used in the final calculations of the analyte concentration (Sect. 11.2).
- **10.8 Initial Calibration -** Demonstration and documentation of acceptable initial calibration is required before any samples are analyzed. After the initial calibration is successful, a CCV is required at the beginning and end of each period in which analyses are performed, and after every tenth Field Sample.
 - 10.8.1 ESI-MS/MS TUNE
 - **10.8.1.1** Calibrate the mass scale of the MS with the calibration compounds and procedures prescribed by the manufacturer.
 - **10.8.1.2** Optimize the [M-H]- for each method analyte by infusing approximately 0.5-1.0 μg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS parameters (voltages, temperatures, gas flows, etc.) are varied until optimal analyte responses are determined. The method analytes may have different optima requiring some compromise between the optima.
 - **10.8.1.3** Optimize the product ion for each analyte by InfusIng approximately 0.5-1.0 μg/mL of each analyte (prepared in the initial mobile phase conditions) directly into the MS at the chosen LC mobile phase flow rate (approximately 0.4 mL/min). This tune can be done on a mix of the method analytes. The MS/MS parameters (collision gas pressure, collision energy, etc.) are varied until optimal analyte responses are determined. Typically, the carboxylic acids have very similar MS/MS conditions.
 - **10.8.2** Establish LC operating parameters that optimize resolution and peak shape. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

Cautions: LC system components, as well as the mobile phase constituents, contain many of the method analytes in this method. Thus, these PFAS's will build up on the head of the LC column during mobile phase equilibration. To minimize the background PFAS peaks and to keep background levels constant, the time the LC column sits at initial conditions must be kept constant and as short as possible (while ensuring reproducible retention times). In addition, prior to daily use, flush the column with 100% methanol for at least 20 min before initiating a sequence. It may be necessary on some systems to flush other LC components such as wash syringes, sample needles or any other system components before daily use.

10.8.3 Inject a mid-level CAL standard under LC/MS conditions to obtain the retention times of each method analyte. If analyzing for PFTA, ensure that the LC

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conditions are adequate to prevent co-elution of PFTA and the mobile phase interferants. These interferants have the same precursor and products ions as PFTA, and under faster LC conditions may co-elute with PFTA. Divide the chromatogram into retention time windows each of which contains one or more chromatographic peaks. During MS/MS analysis, fragment a small number of selected precursor ions ([M-H]-) for the analytes in each window and choose the most abundant product ion. For maximum sensitivity, small mass windows of ± 0.5 daltons around the product ion mass were used for quantitation.

- **10.8.4** Inject a mid-level CAL standard under optimized LC/MS/MS conditions to ensure that each method analyte is observed in its MS/MS window and that there are at least 10 scans across the peak for optimum precision.
 - 10.8.4.1 If broad, split or fronting peaks are observed for the first two eluting chromatographic peaks (if only two analytes are being analyzed, both must be evaluated), change the initial mobile phase conditions to higher aqueous content until the peak asymmetry ratio for each peak is 0.8 1.5. The peak asymmetry factor is calculated as described in Section 9.9.1 on a mid-level CAL standard. The peak asymmetry factor must meet the above criteria for the first two eluting peaks during the IDL and every time a new calibration curve is generated. Modifying the standard or extract composition to more aqueous content to prevent poor shape is not permitted.

NOTE: PFHxS, PFOS, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to chromatographic resolution of the linear and branched isomers of these compounds. Most PFAS's are produced by two different processes. One process gives rise to linear PFAS's only while the other process produces both linear and branched isomers. Thus, both branched and linear PFAS's can potentially be found in the environment. For the aforementioned compounds that give rise to more than one peak, all the chromatographic peaks observed in the standard must be integrated and the areas totaled. Chromatographic peaks in a sample must be integrated in the same way as the CAL standard.

- **10.8.5** Prepare a set of CAL standards as described in Section 8.2.5. The lowest concentration CAL standard must be at or below the RL (2 ng/L), which may depend on system sensitivity.
- **10.8.6** The LC/MS/MS system is calibrated using the IS technique. Use the LC/MS/MS data system software to generate a linear regression or quadratic calibration curve for each of the analytes. This curve **must always** be forced through zero and may be concentration weighted, if necessary. Forcing zero allows for a better estimate of the background levels of method analytes. A minimum of 5 levels are required for a linear calibration model and a minimum of 6 levels are required for a quadratic calibration model.
- **10.8.7 CALIBRATION ACCEPTANCE CRITERIA** A linear fit is acceptable if the coefficient of determination (r²) is greater than 0.99. When quantitated using the initial calibration curve, each calibration point, except the lowest point, for each analyte should calculate to be within 70-130% of its true value. The lowest CAL point should calculate to be within 50-150% of its true value. If these criteria cannot be met, the analyst will have difficulty meeting ongoing QC criteria. It is

recommended that corrective action is taken to reanalyze the CAL standards, restrict the range of calibration, or select an alternate method of calibration (forcing the curve through zero is still required).

- **10.8.7.1 CAUTION:** When acquiring MS/MS data, LC operating conditions must be carefully reproduced for each analysis to provide reproducible retention times. If this is not done, the correct ions will not be monitored at the appropriate times. As a precautionary measure, the chromatographic peaks in each window must not elute too close to the edge of the segment time window.
- **10.9 CONTINUING CALIBRATION CHECK (CCV)** Minimum daily calibration verification is as follows. Verify the initial calibration at the beginning and end of each group of analyses, and after every tenth sample during analyses. In this context, a "sample" is considered to be a Field Sample. MBs, CCVs, LCSs, MSs, FDs FRBs and MSDs are not counted as samples. The beginning CCV of each analysis batch must be at or below the RL in order to verify instrument sensitivity prior to any analyses. If standards have been prepared such that all low CAL points are not in the same CAL solution, it may be necessary to analyze two CAL standards to meet this requirement. Alternatively, the analyte concentrations in the analyte PDS may be customized to meet these criteria. Subsequent CCVs should alternate between a medium and Low concentration CAL standard.
 - **10.9.1** Inject an aliquot of the appropriate concentration CAL standard and analyze with the same conditions used during the initial calibration.
 - **10.9.2** Calculate the concentration of each analyte and EIS in the CCV. The calculated amount for each analyte for medium level CCVs must be within ± 30% of the true value with an allowance of 10% of the reported analytes to be greater than 30%, but less than 40%. The calculated amount for each EIS must be within ± 50% of the true value. The calculated amount for the lowest calibration point for each analyte must be within ± 50%. If these conditions do not exist, then all data for the problem analyte must be considered invalid, and remedial action should be taken (Sect. 10.7.4) which may require recalibration. Any Field or QC Samples that have been analyzed since the last acceptable calibration verification should be reanalyzed after adequate calibration has been restored, with the following exception. If the CCV fails because the calculated concentration is greater than 130% (150% for the low-level CCV) for a particular method analyte, and Field Sample extracts show no detection for that method analyte, non-detects may be reported without re-analysis.
 - **10.9.3** REMEDIAL ACTION Failure to meet CCV QC performance criteria may require remedial action. Major maintenance, such as cleaning the electrospray probe, atmospheric pressure ionization source, cleaning the mass analyzer, replacing the LC column, etc., requires recalibration (Sect 10.6) and verification of sensitivity by analyzing a CCV at or below the RL (Sect 10.7).

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10.10 EXTRACT ANALYSIS

- **10.10.1** Establish operating conditions equivalent to those summarized in Tables 6-8 of Section 16. Instrument conditions and columns should be optimized prior to the initiation of the IDC.
- **10.10.2** Establish an appropriate retention time window for each analyte. This should be based on measurements of actual retention time variation for each method analyte in CAL standard solutions analyzed on the LC over the course of time. A value of plus or minus three times the standard deviation of the retention time obtained for each method analyte while establishing the initial calibration and completing the IDC can be used to calculate a suggested window size. However, the experience of the analyst should weigh heavily on the determination of the appropriate retention window size.
- **10.10.3** Calibrate the system by either the analysis of a calibration curve (Sect. 10.6) or by confirming the initial calibration is still valid by analyzing a CCV as described in Section 10.7. If establishing an initial calibration, complete the IDC as described in Section 13.2.
- **10.10.4** Begin analyzing Field Samples, including QC samples, at their appropriate frequency by injecting the same size aliquots under the same conditions used to analyze the CAL standards.
- **10.10.5** At the conclusion of data acquisition, use the same software that was used in the calibration procedure to identify peaks of interest in predetermined retention time windows. Use the data system software to examine the ion abundances of the peaks in the chromatogram. Identify an analyte by comparison of its retention time with that of the corresponding method analyte peak in a reference standard.
- **10.10.6** The analyst must not extrapolate beyond the established calibration range. If an analyte peak area exceeds the range of the initial calibration curve, the sample should be re-extracted with a reduced sample volume in order to bring the out of range target analytes into the calibration range. If a smaller sample size would not be representative of the entire sample, the following options are recommended. Re-extract an additional aliquot of sufficient size to insure that it is representative of the entire sample. Spike it with a higher concentration of internal standard. Prior to LC/MS analysis, dilute the sample so that it has a concentration of internal standard equivalent to that present in the calibration standard. Then, analyze the diluted extract.

11. Data Evaluation, Calculations and Reporting

- **11.1** Complete chromatographic resolution is not necessary for accurate and precise measurements of analyte concentrations using MS/MS. In validating this method, concentrations were calculated by measuring the product ions listed in Table 7.
- **11.2** Calculate analyte concentrations using the multipoint calibration established in Section 10.6. Do not use daily calibration verification data to quantitate analytes in samples. Adjust final analyte concentrations to reflect the actual sample volume determined in Section 10.6 where:

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 C_{ex} = (Area of target analyte * Concentration of Labeled analog) / (area of labeled analog * CF)

 $C_s = (C_{ex} / sample volume in ml) * 1000$

 C_{ex} = The concentration of the analyte in the extract CF = calibration factor from calibration.

- **11.3** Prior to reporting the data, the chromatogram should be reviewed for any incorrect peak identification or poor integration.
- **11.4** PFHxS, PFOS, PFOA, NMeFOSAA, and NEtFOSAA have multiple chromatographic peaks using the LC conditions in Table 5 due to the linear and branch isomers of these compounds (Sect. 10.6.4.1). The areas of all the linear and branched isomer peaks observed in the CAL standards for each of these analytes must be summed and the concentrations reported as a total for each of these analytes.
- **11.5** Calculations must utilize all available digits of precision, but final reported concentrations should be rounded to an appropriate number of significant figures (one digit of uncertainty), typically two, and not more than three significant figures.

12. Contingencies for Handling Out-of-Control Data or Unacceptable Data

- **12.1** Section 9.0 outlines sample batch QC acceptance criteria. If non-compliant organic compound results are to be reported, the Organic Section Head and/or the Laboratory Director, and the Operations Manager must approve the reporting of these results. The laboratory Project Manager shall be notified, and may choose to relay the non-compliance to the client, for approval, or other corrective action, such as re-sampling and re-analysis. The analyst, Data Reviewer, or Department Supervisor performing the secondary review initiates the project narrative, and the narrative must clearly document the non-compliance and provide a reason for acceptance of these results.
- **12.2** All results for the organic compounds of interest are reportable without qualification if extraction and analytical holding times are met, preservation requirements (including cooler temperatures) are met, all QC criteria are met, and matrix interference is not suspected during extraction or analysis of the samples. If any of the below QC parameters are not met, all associated samples must be evaluated for re-extraction and/or re-analysis.

13. Method Performance

13.1 Detection Limit Study (DL) / Limit of Detection Study (LOD) / Limit of Quantitation (LOQ)

13.1.1 The laboratory follows the procedure to determine the DL, LOD, and/or LOQ as outlined in Alpha SOP ID 1732. These studies performed by the laboratory are maintained on file for review.

13.2 Demonstration of Capability Studies

- **13.2.1** The IDC must be successfully performed prior to analyzing any Field Samples. Prior to conducting the IDC, the analyst must first generate an acceptable Initial Calibration following the procedure outlined in Section 10.6.
- **13.2.2** INITIAL DEMONSTRATION OF LOW SYSTEM BACKGROUND Any time a new lot of SPE cartridges, solvents, centrifuge tubes, disposable pipets, and autosampler vials are used, it must be demonstrated that an MB is reasonably free of contamination and that the criteria in Section 9.2.1 are met. If an automated extraction system is used, an MB should be extracted on each port to ensure that all the valves and tubing are free from potential PFAS contamination.
- **13.2.3** INITIAL DEMONSTRATION OF PRECISION (IDP) Prepare, extract, and analyze four to seven replicate LCSs fortified near the midrange of the initial calibration curve according to the procedure described in Section 10. Sample preservatives as described in Section 6.2.1 must be added to these samples. The relative standard deviation (RSD) of the results of the replicate analyses must be less than 20%.
- **13.2.4** INITIAL DEMONSTRATION OF ACCURACY (IDA) Using the same set of replicate data generated for Section 13.2.3, calculate average recovery. The average recovery of the replicate values must be within ± 30% of the true value.
- **13.2.5** INITIAL DEMONSTRATION OF PEAK ASYMMETRY FACTOR Peak asymmetry factors must be calculated using the equation in Section 9.10.1 for the first two eluting peaks (if only two analytes are being analyzed, both must be evaluated) in a mid-level CAL standard. The peak asymmetry factors must fall in the range of 0.8 to 1.5. See guidance in Section 10.6.4.1 if the calculated peak asymmetry factors do not meet the criteria.
- **13.2.6** Refer to Alpha SOP ID 1739 for further information regarding IDC/DOC Generation.
- **13.2.7** The analyst must make a continuing, annual, demonstration of the ability to generate acceptable accuracy and precision with this method.

14. Pollution Prevention and Waste Management

- **14.1** Refer to Alpha's Chemical Hygiene Plan and Hazardous Waste Management and Disposal SOP for further pollution prevention and waste management information.
- **14.2** This method utilizes SPE to extract analytes from water. It requires the use of very small volumes of organic solvent and very small quantities of pure analytes, thereby minimizing the potential hazards to both the analyst and the environment as compared to the use of large volumes of organic solvents in conventional liquid-liquid extractions.
- **14.3** The analytical procedures described in this method generate relatively small amounts of waste since only small amounts of reagents and solvents are used. The matrices of concern are finished drinking water or source water. However, laboratory waste management practices must be conducted consistent with all applicable rules and regulations, and that laboratories protect the air, water, and land by minimizing and controlling all releases from fume hoods and bench operations. Also, compliance is required with any sewage discharge permits and regulations, particularly the hazardous waste identification rules and land disposal restrictions.

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15. Referenced Documents

Chemical Hygiene Plan - ID 2124

SOP ID 1732 Detection Limit (DL), Limit of Detection (LOD) & Limit of Quantitation (LOQ) SOP

SOP ID 1739 Demonstration of Capability (DOC) Generation SOP

SOP ID 1728 Hazardous Waste Management and Disposal SOP

16. Attachments

Table 7: LC Method Conditions

Time (min)	2 mM Ammonium Acetate (5:95 MeOH/H ₂ O)	100% Methanol			
Initial	100.0	0.0			
1.0	100.0	0.0			
2.2	85.0	15.0			
11	20.0	80.0			
11.4	0.0	100.0			
12.4	100.0	00.0			
15.5 100.0 0.0					
Waters Aquity UPLC ® BEHC ₁₈ 2.1 x 50 mm packed with 1.7 µm BEH C ₁₈					
	stationary phase				
	Flow rate of 0.4 mL/min				

2-5 µL injection

Та	ıble	8:	ESI-MS	Method	Conditions
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ESI Conditions			
Polarity	Negative ion		
Capillary needle voltage	.5 kV		
Cone Gas Flow	25 L/hr		
Nitrogen desolvation gas	1000 L/hr		
Desolvation gas temp.	500 °C		

Table 9: Method Analyte Source, Retention Times (RTs), and EIS References

#	Analyte	Transition	RT	IS	Туре
1	МЗРВА	216>171	2.65		REC
2	PFBA	213 > 169	2.65	2: M4PFBA	
3	M4PFBA	217 > 172	2.65	1: M3PBA	EIS
4	PFPeA	263 > 219	5.67	4: M5PFPEA	
5	M5PFPEA	268 > 223	5.66	1: M3PBA	EIS
6	PFBS	299 > 80	6.35	6: M3PFBS	
7	M3PFBS	302 > 80	6.35	29:M4PFOS	EIS
8	FtS 4:2	327 > 307	7.47	9: M2-4:2FTS	

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Alpha Analytical, Inc. Facility: Mansfield, MA Department: Semivolatiles <u>Title: PFAS by SPE and LC/MS/MS Isotope Dilution</u>

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#	Analyte	Transition	RT	IS	Туре
9	M2-4:2FTS	329 > 81	7.47	29:M4PFOS	EIS
10	PFHxA	303 > 269	7.57	10: M5PFHxA	
11	M5PFHxA	318 > 273	7.57	19:M2PFOA	EIS
12	PFPeS	349 > 80	7.88	18: M3PFHxS	
13	PFHpA	363 > 319	8.80	14: M4PFHpA	
14	M4PFHpA	367 > 322	8.80	19:M2PFOA	EIS
15	L-PFHxS	399 > 80	8.94	18: M3PFHxS	
16	br-PFHxS	399 > 80	8.72	18: M3PFHxS	
17	PFHxS Total	399 > 80	8.94	18: M3PFHxS	
18	M3PFHxS	402 > 80	8.94	29:M4PFOS	EIS
19	MPFOA	415 > 370	9.7		REC
20	PFOA	413 > 369	9.7	23: M8PFOA	
21	br-PFOA	413 > 369	9.48	23: M8PFOA	
22	PFOA Total	413 > 369	9.7	23: M8PFOA	
23	M8PFOA	421 > 376	9.7	19: M2PFOA	EIS
24	FtS 6:2	427 > 407	9.66	25: M2-6:2FTS	
25	M2-6:2FTS	429 > 409	9.66	29:M4PFOS	EIS
26	PFHpS	449 > 80	9.78	33: M8PFOS	
27	PFNA	463 > 419	10.41	33: M8PFOS	
28	M9PFNA	472 > 427	10.41	19: M2PFOA	EIS
29	M4PFOS	501 > 80	10.45		REC
30	PFOS	499 > 80	10.45	33: M8PFOS	
31	br-PFOS	499 > 80	10.27	33: M8PFOS	
32	PFOS Total	499 > 80	10.45	33: M8PFOS	
33	M8PFOS	507 > 80	10.45	29: M4PFOS	EIS
34	FtS 8:2	527 > 507	10.99	38: M2-8:2FTS	
35	M2-8:2FTS	529 > 509	10.99	29:M4PFOS	EIS
36	M2PFDA	515 > 470	11.00		REC
37	PFDA	513 > 469	11.00	38: M6PFDA	
38	M6PFDA	519 > 474	11.00	36: M2PFDA	EIS
39	PFNS	549 > 80	11.02	33:M8PFOS	
40	NMeFOSAA	570 > 419	11.41	41: D3-NMeFOSAA	
41	d3-NMeFOSAA	573 > 419	11.41	36: M2PFDA	EIS
42	PFOSA	498 > 78	11.48	29: M8FOSA	
43	M8FOSA	506 > 78	11.48	19: M2PFOA	EIS
44	PFUnDA	563 > 519	11.51	41: M7-PFUDA	
45	M7-PFUDA	570 > 525	11.51	36: M2PFDA	EIS
46	PFDS	599 > 80	11.51	33:M8PFOS	
47	NEtFOSAA	584 > 419	11.68	48: d5-NEtFOSAA	

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Alpha Analytical, Inc. Facility: Mansfield, MA Department: Semivolatiles Title: PFAS by SPE and LC/MS/MS Isotope Dilution

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#	Analyte	Transition	RT	IS	Туре
48	d5-NEtFOSAA	589 > 419	11.68	36: M2PFDA	EIS
49	PFDoA	613 > 569	11.96	50: MPFDOA	
50	MPFDOA	615 > 570	11.96	36: M2PFDA	EIS
51	PFTriA	663 > 619	12.34	50: MPFDOA	
52	PFTeA	713 > 669	12.6	53: M2PFTEDA	
53	M2PFTEDA	715 > 670	12.6	36: M2PFDA	EIS
54	M3HFPO-DA	329>285	7.97	19: M2PFOA	EIS
55	HFPO-DA	332>287	7.97	54: M3HFPO-DA	
56	ADONA	377>251	8.00	23: M8PFOA	
57	PFHxDA	813>769	13.20	59: M2PFHxDA	
58	PFODA	913>869	13.50	59: M2PFHxDA	
59	M2PFHxDA	815>770	13.20	36:M2PFDA	EIS
60	NEtFOSA	526>169	11.00	61: NMeFOSA	
61	NMeFOSA	512>169	10.50	63: d3-NMeFOSA	
62	d3-NMeFOSA	515>169	10.50	29: M4PFOS	EIS
63	d5-NEtFOSA	531>169	11.00	29: M4PFOS	EIS
64	NMeFOSE	556>122	11.25	66: d7-NMeFOSE	
65	NEtFOSE	570>136	10.75	67: d9-NEtFOSE	
66	d7-NMeFOSE	563>126	11.25	29: M4PFOS	EIS
67	d9-NEtFOSE	579>142	10.75	29: M4PFOS	EIS
68	FtS 10:2	627>607	11.50	25: M2-6:2FTS	
69	PFDoS	699>99	12.50	33: M8PFOS	

ATTACHMENT C

RESUMES

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA). New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments; contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY
- 627 Smith Street (RI and Report), Brooklyn, NY
- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP),



EDUCATION

M.S., Environmental Engineering Columbia University

B.S., Chemistry, Environmental Toxicology (Business Administration minor) Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter, Communications Committee

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member



New York, NY

- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY
- Greenpoint Terminal Market (BCP), Brooklyn, NY
- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

NYC Brownfield Partnership, member Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

LANGAN
STUART KNOOP, PG, LEED AP

SENIOR PROJECT MANAGER

REMEDIAL AND GEOLOGICAL INVESTIGATIONS

Mr. Knoop is a geologist with experience at sites in New York, Connecticut, North Carolina, South Carolina, and Georgia. He has managed high profile, multi-disciplinary projects and worked extensively on projects under City and State regulatory oversight in New York City. Mr. Knoop has developed remedial action and waste management plans and executed remedial investigations, remedial actions, closures at brownfield sites, and former MGP and commercial development sites throughout New York City. He has conducted numerous Phase I and Phase II Environmental Site Assessments, and coordinated remedial action programs at commercial, residential, industrial, telecommunication, and undeveloped sites. He has also coordinated an on-call environmental contract with the New York City School Construction Authority and managed sites under the New York State Brownfield Cleanup Program, and the New York City Voluntary Cleanup Program.

Mr. Knoop's experience includes coordination of free product recovery, development of soil vapor mitigation systems, and implementation of soil and groundwater remediation programs utilizing soil vapor extraction, air sparging, chemical injection, and contaminant removal. He has also supervised the assessment and removal of petroleum underground storage tanks in accordance with state regulatory standards. Additional experience includes extensive geologic mapping, stable isotope reaction and transport modeling, geotechnical analysis of soil and rock for highway, and utility construction projects.

SELECTED PROJECTS

- Queens Plaza Park, Long Island City, NY
- Red Hook Development Sites, Brooklyn, NY
- 173-177 Harrison Avenue, Brooklyn, NY
- Gotham West Development (Studio City), New York, NY
- NYCHA, On-Call Environmental Contract, New York, NY
- Kingsbridge Armory Redevelopment, Bronx, NY
- 54 Rutledge Street Property, Brooklyn, NY
- Peter Cooper Village/Stuyvesant Town Utility Replacement Project, New York, NY
- Former Linen Cleaning Facility, Bronx, NY
- New York Sports Complex and Convention Center, New York, NY
- West Side Site, New York, NY
- Rikers Island Correctional Facility, East Elmhurst, NY
- Macon County School Bus Garage, Franklin, NC
- Skyland Distributing Facility, Asheville, NC
- Rental Uniform Facilities, Various Locations, Nationwide
- Interstate Brands Corporation, Winston-Salem, NC



EDUCATION

M.S., Geology University of British Columbia

B.A., Economics and Environmental Studies Oberlin College

Hydrogeology and Geology Coursework University of Texas

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY, NC

LEED Accredited Professional (LEED AP)

10-Hour OSHA

CPR and First Adi Certified

AFFILIATIONS

Geological Society of America

Geological Association of New Jersey

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

"Small Site, Big Challenges: Negotiating Overlapping Regulatory Commitments for a Private School Development in Emergent, Post-Industrial Brooklyn, NY", Poster Session, 2012 Langan Environmental Workshop, New Brunswick, NJ.

An Introduction to Phase I Environmental Site Assessments, Co-Presenter for Langan Training Webinar, November 2011.

"New Evidence for Syn-Tectonic Fluid Migration across the Hinterland-Foreland Transition of the Canadian Cordillera", Journal of Geophysical Research, *v. 107*, Knoop, S., Kennedy, L., and Dipple, G. 2002.

"Were the Hinterland and Foreland Hydrologically Coupled during Mesozoic Contraction?", Abstracts with Programs, Geological Society of America, Annual Meeting, Knoop, S., Kennedy, L., and Dipple, G. 1999. Presented at October 1999 meeting in Denver, CO.

"New Evidence for the Flow of Hinterland-Derived Fluids Into the Canadian Rockies During Mesozoic Contraction.", Abstracts with Programs, Geological Association of Canada, Annual Meeting, 2000. Presented as poster at May 2000 meeting in Calgary, AB. Knoop, S., Kennedy, L., and Dipple, G.

Anthony Moffa, Jr., ASP, CHMM, COSS

Associate/Corporate Health and Safety Manager

20 years in the industry

Mr. Moffa is Langan's Corporate Health & Safety Manager and is responsible for managing health and safety compliance in all Langan office locations. He has over 20 years' experience in the health and safety field. He is responsible for ensuring compliance with all federal and state occupational health and safety laws and development and implementation of corporate health and safety policies. Responsibilities include reviewing and updating Langan's Corporate Health and Safety Program and assisting employees in the development of site specific Health & Safety Plans. He maintains and manages health and safety records for employees in all Langan office locations including medical evaluations, respirator fit testing, and Hazardous Waste Operations and Emergency Response training. He is also responsible for documentation and investigation of work-related injuries and incidents and sharing this information with employees to assist in the prevention of future incidents. He is also the chairman of the Corporate Health & Safety Committee and Health & Safety Leadership Team that meet periodically throughout the year. He is responsible for coordinating and providing health and safe training to Langan employees. He was formerly the Environmental, Health and Safety Coordinator at a chemical manufacturer. His experience included employee hazard communications, development of material safety data sheets for developed products, respirator fit testing and conducting required Occupational Health & Safety Association and Department of Transportation training.

Selected Projects

Verizon - Pennsylvania, Inc. Philadelphia Naval Yard, PA Confidential Client, Philadelphia, PA Penn Color, Doylestown, PA Verizon - Pennsylvania, Inc., Phase I Environmental Assessment, Lansdowne, PA Verizon - Pennsylvania, Inc. (formerly Bell Atlantic Corporation), Various Locations, PA Kinder Morgan Bulk Terminals, Inc. Fairless Hills, PA PP&L – Martins Creek, Bangor, PA Concord Beverage Company, Concordville, PA Penn Color, Hatfield, PA National Starch & Chemical Company, Bloomfield, NJ Air Products and Chemicals, Inc., Middlesex, NJ PSEG Services Corporation, Jersey City, NJ Sampson Coatings, Richmond, VA Custom Chemicals Corporation, Elmwood Park, NJ



Education

B.S., Physics West Chester University

Professional Registration

Associate Safety Professional (ASP)

Certified Hazardous Material Manager (CHMM)

Certified Occupational Safety Specialist (COSS)

Affiliations

Pennsylvania Chamber of Business & Industry

Chemical Council of New Jersey

New Jersey Business & Industry Association

Geoprofessional Business Association

Certifications and Training

Hazardous Waste Operations and Emergency Response Training

OSHA Site Supervisor Training

10 & 30-Hour Construction Safety & Health Training

30-Hour Construction Safety & Health Training

10-Hour Industry Safety & Health Training

Confined Space Awareness & Entry

Competent Person in Excavations

Hazard Communications

Defensive Driving Training



WILLIAM BOHRER, PG

PROJECT GEOLOGIST GEOLOGIST

Mr. Bohrer is an experienced geologist responsible for managing Langan's environmental standards and Health and Safety compliance for projects throughout New York City. His services include dissemination of environmental protocols, troubleshooting at project sites, in-house/field training, and maintenance of quality standards across the environmental discipline. Mr. Bohrer has a diverse and extensive background in geophysics, hydrogeology, mining and petroleum, and geotechnical engineering. He has developed conceptual site models for public, industrial and commercial facilities nationwide.

SELECTED PROJECTS

- NYU Poly 122 Johnson Street, Brooklyn, NY
- Con Edison of New York at Governor's Island, NY, NY
- 535 4th Avenue, Brooklyn, NY
- 27 Wooster Street, New York, NY
- 42 West Street, Brooklyn, NY
- 455 West 19th Street, New York, NY
- Kings Plaza Mall, Brooklyn, NY
- Hudson Yards "Terra Firma," New York, NY
- Hudson Yards, Platform Special Inspection, New York, NY
- PSAC II, Bronx, NY
- 595-647 Smith Street, Brooklyn, NY
- New York University, 7-13 Washington Square North Investigation, New York, NY
- NYU 4 Washington Square Village, New York, NY
- 125th Street and Lenox Avenue, New York, NY
- Sullivan Street Development, New York, NY
- Hudson Crossing II, New York, NY
- New York Aquarium, Shark Tank & Animal Care Facility, Brooklyn, NY
- 209-219 Sullivan Street, New York, NY
- 261 Hudson Street, New York, NY
- 460 Washington Street, New York, NY
- 552 West 24th Street, New York, NY
- Brooklyn Bridge Park Pier 1, New York, NY
- International Leadership Bronx Charter School, Bronx, NY
- 203 East 92nd Street, New York, NY
- HighLine 28-29, New York, NY
- 539 Smith Street Bulkhead, Brooklyn, NY
- Willets Point, Corona, NY
- Plume Migration and Fracture Flow Aquifer Investigation, Brunswick, MD
- Plume Migration and Fracture Flow Aquifer Investigation, Fallston, MD
- Emergency Response Site Investigation & Remediation, Wappingers Falls, NY
- Emergency Response Site Investigation & Remediation, Allentown, PA



EDUCATION

Post Graduate Studies in Geophysics Cornell University

B.S., Geology Tufts University

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY

40 Hour OSHA HazWOPER

OSHA Construction Safety & Health

OSHA Supervisory Certification Credential (TWIC)

Transportation Worker Identification

NYS DEC- Protecting New York's Natural Resources with Better Construction Site Management

AFFILIATIONS

American Association of Petroleum Geologists

National Groundwater Association

Geological Society of America



- Emergency Response Site Investigation & Remediation, Shamokin, PA
- Bermuda International Airport, Jet Fuel Release Investigation, Bermuda
- Little Missouri River Basin, Geotechnical Site Evaluation (Horizontal Drilling Pipeline Install), ND
- Seismic Susceptibility Evaluation (Class 2 Injection Wells), Litchfield, OH
- Bedrock Mapping, Bradford and Sullivan Counties, PA
- Soil Solidification, Carteret, NJ

PA Council of Professional Geologists

JULIA LEUNG, PE

PROJECT ENGINEER

ENVIRONMENTAL ENGINEERING & WATER RESOURCES

Ms. Leung is an environmental engineer working in the New York Metro area. Her projects involve the investigation and assessment of environmental systems including physical/chemical processes, water chemistry, environmental system analysis, solid waste and water resources engineering, stormwater design and hydrology.

SELECTED PROJECTS

- Phase I ESA, Various Locations, NYC and Westchester County, NY
- Phase II ESI, 412 East 90th Street, New York, NY
- 420 Kent Avenue, Brooklyn, NY
- West and Watts Development, New York, NY
- 203 East 92nd Street, Mixed-Use Building, New York, NY
- BAM North Tower, Brooklyn, NY
- Phase II ESI, FedEx Distribution Facility (830 Fountain Avenue), Brooklyn, NY
- Waste Classification and Lead Delineation Investigation (261 Hudson Street), New York, NY
- Waste Classification Investigation (41-43 East 22nd Street), New York, NY
- Columbia University, Manhattanville Campus, New York, NY
- Riverside Building 5, New York, NY
- Condominium at 200 East 79th Street, New York, NY
- Mercedes Benz of Manhattan (536 West 41st Street), New York, NY
- Phase II ESI (627 Smith Street), Brooklyn, NY
- 340 Court Street, Brooklyn, NY
- 460 Washington Street, New York, NY
- 208 East 79th Street, New York, NY
- 320 Fordham Landing, Bronx, NY
- Greenpoint Landing, Brooklyn, NY
- ABC Block 25, ABC Block 26, ABC Block 27, Long Island City, NY
- 80 Flatbush Avenue, Brooklyn, NY
- 2409 Jerome Avenue, Bronx, NY
- Bronx Point, Bronx, NY
- 4650 Broadway, New York, NY
- 445 Gerard Avenue and 414 Gerard Avenue, Bronx, NY



EDUCATION

M.E., Environmental Engineering Cornell University

B.S., Biological Engineering (Environmental Studies Concentration) Cornell University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

10-Hour OSHA

AFFILIATIONS

American Society of Civil Engineers (ASCE)

LANGAN

JOSHUA GOLDING, PE

SENIOR STAFF ENGINEER

ENVIRONMENTAL ENGINEERING

Mr. Golding is an environmental engineer with experience in excavation oversight, waste classification, Community Air Monitoring Programs (CAMP), regulatory reporting, and soil/groundwater sampling. He has provided cleanup services for sites in New York City and upstate New York. He also has experience in the site/civil industry in Sydney, Australia.

SELECTED PROJECTS

- Keller Hotel, Manhattan, New York, NY
- Evergreen Charter School, Hempstead, NY
- Greenpoint Marina, Brooklyn, New York, NY
- Bush Terminal, Brooklyn, New York, NY
- 215 North 10th Street, Brooklyn, New York, NY
- 445 Gerard Avenue, Bronx, New York, NY
- 4650 Broadway, Manhattan, New York, NY
- Jackson Park Residential Development, Queens, New York, NY
- Coney Island Amphitheater, Brooklyn, New York, NY
- 388 Bridge Street, Brooklyn, New York, NY
- A. Duie Pyle Bronz Truck Depot, Bronx, New York, NY
- One Hudson Yards, Manhattan, New York, NY
- 511 West 21st Street, Manhattan, New York, NY
- 32-00 Skillman Avenue, Queens, New York, NY
- UTS Engineering Building, Sydney, Australia
- UNSW Tyree Energy Technologies Building, Sydney, Australia



EDUCATION

B.E., Civil and Environmental Engineering University of Technology, Sydney

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in TX

OSHA 10 Hour

OSHA 40 Hour HAZWOPER

NYCDEC Stormwater Pollution Prevention and Control Certificate

HEATHER NUNN, GISP

PROJECT DATA ANALYST IT/CADD/GIS

Ms. Nunn has over nine years of experience with database design, management and visualization using EarthSoft EQuIS database and ESRI ArcGIS in support of environmental site characterizations for sites regulated under federal and state compliance programs. Her expertise includes integration of analytical databases and GIS.

In her current role, Ms. Nunn assists project teams with planning and implementation of project databases and data visualization. This includes coordinating with field staff and laboratories to define workflows, ensure the receipt of the proper deliverables for field and lab data; reviewing and managing project data and information using EQuIS, Microsoft Access, and Excel; generating data reports including tables, graphs, charts, and GIS compatible files; and generating and reviewing electronic data deliverables following project or agency specific formats. Ms. Nunn also assists project teams with GIS tasks including spatial analysis, report figure generation, software conversions and general support.

SELECTED PROJECTS

- Air Products and Chemicals, Various Locations, NJ
- Brodson-Montville, NJ
- CERCLA 554 Old Water Works Rd, Old Bridge, NJ
- Confidential Client Phase II ESA AL, CA, CT, FL, IL, IN, KS, KY, LA, MD, MA, MD, MI, MN, MO, NH, NJ, NM, NY, OH, PA, TX, UT, VA, WA,
- Curtiss Wright, NJ
- Former Roche Facility, Belleville, NJ
- JCP&L, Various locations, NJ
- NPDES Landfill Compliance Sampling & Reporting, West Union, WV
- PRC, Paulsboro, NJ
- Project Flash, Gold Coast, FL
- UPMC, Various Locations, PA
- US Steel, Tullytown, PA
- Various NYC BCP projects

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

Best Data Management Practices in GIS - NEARC Newport, Rhode Island (November 2017)

Interactive ESA Mapping Rutgers - DPCC Continuing Professional Education Class New Brunswick, NJ, March 1017

Querying an EQuIS Database in ArcGIS, Esri User Conference Poster Presentation, San Diego, California, June 2016.

Batch Contour Creation in Minutes Using EQuIS for ArcGIS, Esri User Conference Poster Presentation, San Diego, California, June 2016.



EDUCATION

B.S., Geography Indiana University of Pennsylvania

B.S., Regional Planning Indiana University of Pennsylvania

PROFESSIONAL REGISTRATION

GISP License #: 99268

AFFILIATIONS

Perkasie Planning Commission

URISA

Pennsylvania Mapping and Geographic Information Consortium

Women in GIS

JOSEPH CONBOY

Mr. Conboy has seven years of environmental chemistry, quality assurance, and environmental database management experience, with a current emphasis on validation of laboratory data for submittal to NJDEP via the New Jersey Data of Known Quality Protocols and to NYSDEC. Previous work experience includes performing validation of data for projects in USEPA Regions 2 and 3 while employing appropriate validation guidelines for each region, managing large data sets, updating appropriate regulatory limits, performing statistical evaluations, and preparing electronic data deliverables and report deliverables using the Earthsoft EQuIS database program, and acted as an intermediary between project managers, field staff, and laboratories. Mr. Conboy also has experience in field sampling techniques and maintains current OSHA HAZWOPER certification.

SELECTED PROJECTS

- 1400 Ferris, Bronx, NY Completed validation of soil and groundwater data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOCs and SVOCs including 1,4-dioxane, and tangentially used based on professional judgment to perform validation of PFAS data.
- Broome Street Parking Lot, NY Completed validation of waste characterization data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOCs, SVOCs, herbicides, PCBs, pesticides, metals including mercury, ignitability temperature, pH, reactive cyanide, reactive sulfide, cyanide, and hexavalent chromium. Toxicity characteristic leachate procedure extraction data for VOCs, SVOCs, herbicides, pesticides, metals, and mercury were also validated.
- 215 North 10th Street, Brooklyn, NY Completed validation of soil and groundwater data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data.
- 35 Commercial Street, Brooklyn, NY Completed validation of soil data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data, and tangentially used based on professional judgment to perform validation of PFAS data.
- Suffolk Street, Lower East Side, NY- Completed validation of soil, groundwater, and soil vapor data and prepared the Data Usability Summary Report for submittal to NYSDEC. USEPA Region II

STAFF CHEMIST ENVIRONMNETAL



EDUCATION

B.Sc., Chemistry with a minor in Mathematics Rowan University

CERTIFICATIONS & TRAINING

OSHA 40-Hour HAZWOPER 29 CFR 1910.120(e)(4) Certification

NJ Analytical Guidance and Data Usability Training

USEPA Data Validation Training

Earthsoft EQuIS Environmental Database Training guidelines, with aide from National Functional Guidelines, were employed to perform validation of VOC, VOCs by USEPA TO-15, SVOC, SVOC SIM, herbicide, PCB, pesticide, metals, mercury, cyanide, hexavalent chromium, trivalent chromium data, and tangentially used based on professional judgment to perform validation of PFAS data.

- Managed a database for a confidential client containing 10+ years of environmental chemical data from multiple laboratories, requiring select data validation in accordance with New Jersey Data of Known Quality Protocols and identifying areas of delineation from historic field information. Once identified, NJDEP designated groundwater, surface water, soil, sediment, soil vapor, and custom screening criteria were researched and applied to each area, requiring individualized flagging for reporting.*
- Prepared the New Jersey Data of Known Quality Protocol Data Usability Evaluation and managed the database for a confidential client for a data set greater than 20 years old. A DUE or any validation effort was not prepared in the 20 years prior to current. This included data from variations of methods for volatile organic compounds, semivolatile organic compounds, total and dissolved metals, pesticides, herbicides, natural attenuation parameters, and per- and polyfluoroalkyl substances in multiple media.*
- Performed 200+ Stage 2a validations for a combined 87-acre USEPA designated Corrective Action site under the Resource Conservation and Recovery Act, including a quick-turn USEPA required PCB by soxhlet extraction investigation across multiple plants. Once a former train car painting facility, USEPA required a quick-turn PCB by soxhlet extraction soil investigation.
- Preparation of a quality assurance program for a confidential client in West Virginia. A quick turn QAPP was prepared in a service location new to the consultant, resulting in research into state requirements for data usability and auditing newly employed laboratories. The QAPP was understood to be prepared for groundwater only, but the client did not reveal the need for sediment and soil. Two QAPPs were submitted for review to governing agencies.*
- Used statistical software to determine a localized background upper confidence limit of chromium for a confidential client's sand and gravel site. Validation was used to confirm laboratory procedures, and data was used in ProUCL calculations to compare to researched background chromium levels for Pennsylvania soils. *
- Prepared daily perimeter dust and air monitoring summaries and validation of low level mirex data for a confidential client's superfund site. Low level mirex data was generated by university laboratories and subject to validation following national functional guidelines to aide in river clean-up, including sediment, surface water, and treatment system water matrices.*

*Project completed prior to employment at LANGAN.

ATTACHMENT D

SAMPLE NOMENCLATURE



SAMPLE NOMENCLATURE

The sample nomenclature outlined below provides consistency between sample events and projects but, most importantly, establish unique sample IDs that will avoid confusion months or years after the sample has been collected. Furthermore, unique sample IDs are required for any data submitted to the NYSDEC in EDD format or being uploaded to an EQUIS database.

1.0 INVESTIGATION LOCATION CODES

- SB Soil Boring
- WC Waste Characterization Boring
- TP Test Pit
- EPSW Endpoint Location (Sidewall)
- EPB Endpoint Location (Bottom)
- MW Monitoring Well
- TMW Temporary Monitoring Well
- SW Surface Water

- SV Soil Vapor Point
- IA Indoor Air
- AA Ambient Air
- SVE Vapor Extraction Well
- DS Drum
- IDW Investigation Derived Waste

Sampling Interval (y-y)

- SL Sludge
- FP Free Product

2.0 SAMPLE NOMENCLATURE

Each sample at a site must have a unique value.

• Soil/Sediment Samples:

SBxx_y-y

Sample Location Code + Number (two digits minimum)

Sampling Sample Location Depth or Interval Sample Type Sample Name Code (feet bgs or approx. elevation) Phase II/Remedial Investigation SB01 2 to 4 SB01_2-4 Grab Soil Sample SB02 4 SB02_4 Waste Characterization WC01 WC01 2-4 2 to 4 Grab Soil Sample WC02 WC02_4 4 Composite Soil Sample COMP01 or 0 to 10 from one or more COMP01_0-10 COMP02 + COMP03 (Fill) locations

1

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Sample Type	Sample Location Code	Sampling Depth or Interval (feet bgs or approx. elevation)	Sample Name
Endpoint Sampling			
	EPSW01_N	5	EPSW01_N_5
	EPSW01_S	5	EPSW01_S_5
Grab Soil Sample	EPSW01_E	5	EPSW01_E_5
	EPSW01_W	5	EPSW01_W_5
	EPB01	6	EPB01_6

Groundwater/Surface Water Samples:

MWxx_MMDDYY \geq 1

Sampling Date (MMDDYY)

Sample Location Code + Number (two digits minimum)

Sample Type	Sample Location Code	Sampling Date	Sample Name
Groundwater Sample	MW01	02/21/2013	MW01_022113

• <u>Air/Soil Vapor Samples:</u>

IAxx_MMDDYY

Sampling Date (MMDDYY)

Sample Location Code + Number (two digits minimum)

Sample Type	Sample Location Code	Date	Sample Name
Air Sample	IA01	02/21/2013	IA01_022113
Soil Vapor Sample	SV01	02/21/2013	SV01_022113
Vapor Extraction Well	SVE01		SVE01_IN_022113
Sample	(INLET/MIDPOINT/OUTLET)	02/21/2013	SVE01_ MID_022113 SVE01_ OUT_022113

<u>QA/QC Samples:</u>

Sample Matrix Codes

SO	Soil	AS	Air
SE	Sediment	SV	Soil Vapor
GW	Groundwater	SL	Sludge
SW	Surface Water	FP	Free Product

2



o Duplicates Samples

Sample Matrix Code Sample Type + Sampling Date (MMDDYY) Number (two digits minimum)

Sample Type	Parent Sample Code	Date	Sample Name
Groundwater Duplicate Sample (DUP)	MW01_022113	02/21/2013	GWDUP01_022113
Soil boring Duplicate Sample (DUP)	SBP01_022113	02/21/2013	SODUP01_022113
Grab Waste Characterization	WC01	02/21/2013	WCDUP01_022113
Composite Waste Characterization	COMP01	02/21/2013	COMPDUP01_022113

o Field Blanks and Trip Blanks



Sample Type	Date	Sample Name
Groundwater Field Blank (FB)	02/21/2013	GWFB01_022113
Groundwater Trip Blank (TB)	02/21/2013	GWTB01_022113
Soil Field Blank	02/21/2013	SOFB01_022113
Soil Trip Blank	02/21/2013	SOTB01_022113

• Matrix Spike/Matrix Spike Duplicate (MS/MSD)

Parent Sample Name_MS or MSD

Sample Type	Sample Location	Parent Sample Name	Sample Name
Matrix Spike Soil (MS)	SB01	SB01_2-4	SB01_2-4_MS
Matrix Spike Soil Duplicate (MSD)	SB01	SB01_2-4	SB01_2-4_MSD
Matrix Spike GW (MS)	MW01	MW01	MW01_MS
Matrix Spike GW Duplicate (MSD)	MW01	MW01	MW01_MSD

3.0 NOTES

- 1. The sample location code should not exceed 20 characters and the sample name should not exceed 40 characters.
- 2. Sample location code (**SB01**, **MW01**, **etc.**) is a sequential number (starting with 01) and should be a minimum of two digits.
- 3. Sample Interval (SB01_0-5) is separated from the sample location code with an underscore, and the top and bottom interval with a dash. Soil and sediment sample intervals should always be in

SOP: Sample Nomenclature_v02 | 03/06/2013



feet. Soil and sediment sample intervals should contain no "/" or "()" or unit.

- 4. Sample date (MW01_022113) is separated from the sample location code with an underscore and should be provided in MMDDYY format [the date should contain no "/" or "-"].
- 5. If groundwater samples are collected from multiple intervals within one well, you may assign a letter designation (in lower case) to the well ID to differentiate between intervals (i.e., MW01a_022113, MW01b_022113, and MW01c_022113). The letter "a" would indicate the shallowest interval and "c" the deepest. The actual depth intervals should be documented in the project field book or field sheets and the letter designations should be used consistently between sampling events.
- 6. According to USEPA's Contract Laboratory Program (CLP) Guidance for Field Samplers (January 2011), field duplicate samples should remain "blind" to the laboratory (i.e., they should have separate CLP Sample numbers). Assign two separate (unique) CLP sample numbers (i.e., one number to the field sample and one to the duplicate). Submit blind to the laboratory. (http://www.epa.gov/superfund/programs/clp/download/sampler/CLPSamp-01-2011.pdf)



APPENDIX G Project Personnel Résumés

JASON J. HAYES, PE, LEED AP

PRINCIPAL/VICE PRESIDENT ENVIRONMENTAL ENGINEERING

Mr. Hayes has experience in New York, New Jersey, Washington D.C., California, Washington, Oregon, Alaska, and Internationally. His experience includes Environmental Protection Agency (EPA), New York State (NYS) Brownfields applications, investigation, and remediation; New York City Department of Environmental Protection (NYCDEP) and New York City Office of Environmental Remediation (OER) E-designated site applications, investigations, and remediation. His expertise also includes Phase I and II Environmental Site Investigations and Assessments: contaminated building cleanup and demolition; Underground Storage Tank (UST) permitting, removal specifications, and closure reporting; soil vapor intrusion investigation and mitigation system design (depressurization systems, etc.); development of groundwater contaminant plume migration models; environmental analysis; and oversight, design and specification generation for remediation operations with contaminants of concern to include polychlorinated biphenyls (PCBs), solvents, mercury, arsenic, petroleum products, asbestos, mold and lead.

SELECTED PROJECTS

- NYCDPR Bushwick Inlet Park (Phase I ESA, Approvals for NYC E-Designation), Brooklyn, NY
- WCS New York Aquarium, Shark Tank and Animal Care Facility (Environmental Remediation), Coney Island, NY
- NYC School Construction Authority (PCB Remediation), Various Locations, New York, NY
- 28-29 High Line (Phase I ESA, Phase II ESI, and Environmental Remediation), New York, NY
- Georgetown Heating Plant (Phase II ESI and Remedial Design for Mercury Impacted Site), Washington D.C.
- 268 West Street (BCP Application, RI and RIWP), New York, NY
- Confidential Multiple Mixed-Use Tower Location (BCP Application, RI, Phase I ESA, and Phase II ESI), New York, NY
- Dock 72 at Brooklyn Navy Yard, (NYS Voluntary Cleanup Program), Brooklyn, NY
- 27-21 44th Drive (BCP Application, Remedial Investigation Phase I ESA, and Phase II ESI), Long Island City, NY
- Purves Street Development, BCP Application, RAWP, and Phase II ESI, Long Island City, NY
- 267-273 West 87th Street (BCP Application, Remedial Investigation, RIWP, RAWP), New York, NY
- International Leadership Charter School (Environmental Remediation), Bronx, NY
- West & Watts (BCP Application), New York, NY
- Hudson Yards Redevelopment (Phase I ESA and Phase II ESI), New York, NY
- 627 Smith Street (RI and Report), Brooklyn, NY



EDUCATION

M.S., Environmental Engineering Columbia University

B.S., Chemistry, Environmental Toxicology (Business Administration minor) Humboldt State University

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in NY

LEED Accredited Professional (LEED AP)

Troxler Certification for Nuclear Densometer Training

OSHA 40-Hour HAZWOPER

OSHA HAZWOPER Site Supervisor

AFFILIATIONS

US Green Building Council, NYC Chapter, Communications Committee

Urban Land Institute (ULI), member

Commercial Real Estate Development Associations (NAIOP), member



- Gateway Center II Retail (Phase I ESA and Phase II ESI), Brooklyn, NY
- 261 Hudson Street (Phase I ESA, Phase II ESI, BCP, and RAWP), New York, NY
- Riverside Center, Building 2 (BCP, Phase I ESA and Phase II ESI), New York, NY
- New York Police Academy, (Sub-Slab Depressurization and Vapor Barrier System), College Point, NY
- Bronx Terminal Market (BCP, RIWP, RAWP, Phase I ESA and Phase II ESI), Bronx, NY
- Jacob Javits Convention Center (Phase I ESA and Phase II ESI), New York, NY
- Yankee Stadium Development Waterfront Park (NYSDEC Spill Sites), Bronx, NY
- Silvercup West (BCP, RIWP, RIR, RAWP, and RAA), Long Island City, NY
- 29 Flatbush, Tall Residential Building (Groundwater Studies, RIR and RAWP), Brooklyn, NY
- Gowanus Village I (BCP, RIWP and RIR), Brooklyn, NY
- Sullivan Street Hotel (Site Characterization Study and Owner Representation), New York, NY
- Riker's Island Co-Generation Plant (Soil and Soil Vapor Quality Investigations), Bronx, NY
- The Shops at Atlas Park (Sub-Slab Depressurization and Vapor Barrier Design), Glendale, NY
- Memorial Sloan-Kettering Cancer Center (Subsurface and Soil Vapor Intrusion Investigations), New York, NY
- Element West 59th Street (Oversight and Monitoring of Sub-Slab Depressurization and Vapor Barrier Systems), New York, NY
- Teterboro Airport (Delineation and Remedial Oversight of Petroleum-Contaminated Soils), Teterboro, NJ
- Proposed New York JETS Stadium (Phase I ESA), New York, NY
- Former Con Edison Manufactured Gas Plant Sites (Research Reports), New York, NY
- 7 World Trade Center (Endpoint Sampling and Final Closure Report), New York, NY
- Peter Cooper Village, Environmental Subsurface Investigations, New York, NY
- Greenpoint Terminal Market (BCP), Brooklyn, NY
- Confidential Location (Remediation for Mercury-Contaminated Site), New York, NY
- Confidential Location (Phase II ESI and Remedial Design for Mercury Impacted Site), Brooklyn, NY

SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

NYC Mayor's Office of Environmental Remediation – Big Apple Brownfield Workshop – Presented on Soil Vapor Intrusion Remedies (e.g., SSD Systems, Vapor Barriers, Modified HVAC)

New York City Brownfield Partnership – Presented on environmental considerations and complications of the Hudson Yards Development

NYC Brownfield Partnership, member Waterfront Development Technical Course – Presented on Impacted Waterfront Planning Considerations

STUART KNOOP, PG, LEED AP

SENIOR PROJECT MANAGER

REMEDIAL AND GEOLOGICAL INVESTIGATIONS

Mr. Knoop is a geologist with experience at sites in New York, Connecticut, North Carolina, South Carolina, and Georgia. He has managed high profile, multi-disciplinary projects and worked extensively on projects under City and State regulatory oversight in New York City. Mr. Knoop has developed remedial action and waste management plans and executed remedial investigations, remedial actions, closures at brownfield sites, and former MGP and commercial development sites throughout New York City. He has conducted numerous Phase I and Phase II Environmental Site Assessments, and coordinated remedial action programs at commercial, residential, industrial, telecommunication, and undeveloped sites. He has also coordinated an on-call environmental contract with the New York City School Construction Authority and managed sites under the New York State Brownfield Cleanup Program, and the New York City Voluntary Cleanup Program.

Mr. Knoop's experience includes coordination of free product recovery, development of soil vapor mitigation systems, and implementation of soil and groundwater remediation programs utilizing soil vapor extraction, air sparging, chemical injection, and contaminant removal. He has also supervised the assessment and removal of petroleum underground storage tanks in accordance with state regulatory standards. Additional experience includes extensive geologic mapping, stable isotope reaction and transport modeling, geotechnical analysis of soil and rock for highway, and utility construction projects.

SELECTED PROJECTS

- Queens Plaza Park, Long Island City, NY
- Red Hook Development Sites, Brooklyn, NY
- 173-177 Harrison Avenue, Brooklyn, NY
- Gotham West Development (Studio City), New York, NY
- NYCHA, On-Call Environmental Contract, New York, NY
- Kingsbridge Armory Redevelopment, Bronx, NY
- 54 Rutledge Street Property, Brooklyn, NY
- Peter Cooper Village/Stuyvesant Town Utility Replacement Project, New York, NY
- Former Linen Cleaning Facility, Bronx, NY
- New York Sports Complex and Convention Center, New York, NY
- West Side Site, New York, NY
- Rikers Island Correctional Facility, East Elmhurst, NY
- Macon County School Bus Garage, Franklin, NC
- Skyland Distributing Facility, Asheville, NC
- Rental Uniform Facilities, Various Locations, Nationwide
- Interstate Brands Corporation, Winston-Salem, NC



EDUCATION

M.S., Geology University of British Columbia

B.A., Economics and Environmental Studies Oberlin College

Hydrogeology and Geology Coursework University of Texas

PROFESSIONAL REGISTRATION

Professional Geologist (PG) in NY, NC

LEED Accredited Professional (LEED AP)

10-Hour OSHA

CPR and First Adi Certified

AFFILIATIONS

Geological Society of America

Geological Association of New Jersey



SELECTED PUBLICATIONS, REPORTS, AND PRESENTATIONS

"Small Site, Big Challenges: Negotiating Overlapping Regulatory Commitments for a Private School Development in Emergent, Post-Industrial Brooklyn, NY", Poster Session, 2012 Langan Environmental Workshop, New Brunswick, NJ.

An Introduction to Phase I Environmental Site Assessments, Co-Presenter for Langan Training Webinar, November 2011.

"New Evidence for Syn-Tectonic Fluid Migration across the Hinterland-Foreland Transition of the Canadian Cordillera", Journal of Geophysical Research, v. 107, Knoop, S., Kennedy, L., and Dipple, G. 2002.

"Were the Hinterland and Foreland Hydrologically Coupled during *Mesozoic Contraction?*", Abstracts with Programs, Geological Society of America, Annual Meeting, Knoop, S., Kennedy, L., and Dipple, G. 1999. Presented at October 1999 meeting in Denver, CO.

"New Evidence for the Flow of Hinterland-Derived Fluids Into the Canadian Rockies During Mesozoic Contraction.", Abstracts with Programs, Geological Association of Canada, Annual Meeting, 2000. Presented as poster at May 2000 meeting in Calgary, AB. Knoop, S., Kennedy, L., and Dipple, G.

JOSHUA GOLDING, PE

SENIOR STAFF ENGINEER

ENVIRONMENTAL ENGINEERING

Mr. Golding is an environmental engineer with experience in excavation oversight, waste classification, Community Air Monitoring Programs (CAMP), regulatory reporting, and soil/groundwater sampling. He has provided cleanup services for sites in New York City and upstate New York. He also has experience in the site/civil industry in Sydney, Australia.

SELECTED PROJECTS

- Keller Hotel, Manhattan, New York, NY
- Evergreen Charter School, Hempstead, NY
- Greenpoint Marina, Brooklyn, New York, NY
- Bush Terminal, Brooklyn, New York, NY
- 215 North 10th Street, Brooklyn, New York, NY
- 445 Gerard Avenue, Bronx, New York, NY
- 4650 Broadway, Manhattan, New York, NY
- Jackson Park Residential Development, Queens, New York, NY
- Coney Island Amphitheater, Brooklyn, New York, NY
- 388 Bridge Street, Brooklyn, New York, NY
- A. Duie Pyle Bronz Truck Depot, Bronx, New York, NY
- One Hudson Yards, Manhattan, New York, NY
- 511 West 21st Street, Manhattan, New York, NY
- 32-00 Skillman Avenue, Queens, New York, NY
- UTS Engineering Building, Sydney, Australia
- UNSW Tyree Energy Technologies Building, Sydney, Australia



EDUCATION

B.E., Civil and Environmental Engineering University of Technology, Sydney

PROFESSIONAL REGISTRATION

Professional Engineer (PE) in TX

OSHA 10 Hour

OSHA 40 Hour HAZWOPER

NYCDEC Stormwater Pollution Prevention and Control Certificate APPENDIX H Remediation Schedule

APPENDIX H

Remediation Schedule Rego Park Center III Rego Park, NY BCP Site No.: C241259 Langan Project No.: 170683801

			2022							2023											2024										
lten #	Action	JAN	FEB	MAR	APR	MAY	NNſ	JUL	AUG	SEP	NOV	DEC	JAN	FEB	MAR	APR	MAY	JUL	AUG	SEP	ост	NOV	UEC	JAN FEB	MAR	APR	MAY	NUL	JUL	AUG	SEP OCT
	Rego Park Center III																														
1	Site Preperation, Remedial Investigation, and draft RAWP																														
2	RAWP Review, Approval, Public Comment, and Decision Document																														
3	Remedial Excavation and Installation of Engineering Controls																														
4	Final Engineering Report and Site Management Plan Preparation/Submittal																														
5	Filing of Environmental Easement																														
6	FER and SMP Review/Certificate of Completion																														

Notes:

a) RAWP - Remedial Action Work Plan

b) FER - Final Engineering Report

c) SMP - Site Management Plan