76 ELEVENTH AVENUE

NEW YORK, NEW YORK

Excavation and Engineering Controls Protection and Restoration Plan

OER Project Number 13EH-N304M
E-Designation E-142
CEQR Number 03DCP069M for the
Special West Chelsea District Rezoning
Brownfield Cleanup Program Site No. C231036

Prepared For:

76 Eleventh Avenue Property Owner, LLC
600 Madison Avenue
New York, NY 10022

Prepared By:

Langan Engineering, Environmental, Surveying, and Landscape Architecture, D.P.C.
300 Kimball Drive
Parsippany, NJ 07054
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Langan Project No. 100513101

March 10, 2016

CERTIFICATION

I, Satyajit A. Vaidya, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for designing the remedial program for the 76 Eleventh Avenue/17th Street Development site, OER Project Number 13EH-N304M and NYSDEC Site No. C231036. I certify to the following:

- I have reviewed this document and the Stipulation List, to which my signature and seal are affixed.
- Engineering Controls developed for this remedial action were designed by me or a person under my direct supervision and designed to achieve the goals established in this plan for this Site.
- The Engineering Controls to be constructed during the proposed work are accurately reflected in the text and drawings of this document and are of sufficient detail to enable proper construction.
- This Excavation and Engineering Controls Protection and Restoration Plan (EECPRP) has a plan for handling, transport and disposal of soil, fill, fluids and other materials removed from the property in accordance with applicable City, State and Federal laws and regulations. Importation of all soil, fill and other material from off-Site will be in accordance with all applicable City, State and Federal laws and requirements. This EECPRP has provisions to control nuisances during the remediation and all invasive work, including dust and odor suppression.

Satyajit A. Vaidya
Name

089797
PE License Number

Signature

3/10/16
Date

EXCAVATION AND ENGINEERING CONTROLS PROTECTION AND RESTORATION PLAN TABLE OF CONTENTS

FIGURES

APPENDICES

LIST OF ACRONYMS

Acronym	Definition
AOC	Area of Concern
AS/SVE	Air Sparging/Soil Vapor Extraction
BOA	Brownfield Opportunity Area
CAMP	Community Air Monitoring Plan
C&D	Construction and Demolition
CEQR	City Environmental Quality Review
CFR	Code of Federal Regulations
CHASP	Construction Health and Safety Plan
COC	Certificate of Completion
CQAP	Construction Quality Assurance Plan
CSOP	Contractors Site Operation Plan
DCR	Declaration of Covenants and Restrictions
ECs/ICs	Engineering Controls and Institutional Controls
ELAP	Environmental Laboratory Accreditation Program
HASP	Health and Safety Plan
HAZWOPER	Hazardous Waste Operations Emergency Response
IRM	Interim Remedial Measure
MNA	Monitored Natural Attenuation
NOC	Notice of Completion
NYCDEP	New York City Department of Environmental Protection
NYCDOHMH	New York State Department of Health and Mental Hygiene
NYCOER	New York City Office of Environmental Remediation
NYCVCP	New York City Voluntary Cleanup Program
NYCRR	New York Codes Rules and Regulations
NYSDEC	New York State Department of Environmental Conservation
NYSDEC DER	New York State Department of Environmental Conservation Division of Environmental Remediation
NYSDOH	New York State Department of Health

Acronym	Definition
NYSDOT	New York State Department of Transportation
ORC	Oxygen-Release Compound
OSHA	United States Occupational Health and Safety Administration
PCBs	Polychlorinated Biphenyls
PE	Professional Engineer
PID	Photo Ionization Detector
QEP	Qualified Environmental Professional
QHHEA	Qualitative Human Health Exposure Assessment
RAOs	Remedial Action Objectives
RAR	Remedial Action Report
RAWP	Remedial Action Work Plan
RCA	Recycled Concrete Aggregate
RCR	Remedial Closure Report
RD	Remedial Design
RI	Remedial Investigation
RMZ	Residual Management Zone
SCOs	Soil Cleanup Objectives
SCG	Standards, Criteria and Guidance
SMP	Site Management Plan
SPDES	State Pollutant Discharge Elimination System
SSDS	Sub-Slab Depressurization System
SVOC	Semi-Volatile Organic Compound
TAL	Target Analyte List
TCL	Target Compound List
USGS	United States Geological Survey
UST	Underground Storage Tank
VCA	Voluntary Cleanup Agreement
VOC	Volatile Organic Compound

EXECUTIVE SUMMARY

76 Eleventh Avenue Property Owner, LLC is working with the New York City Office of Environmental Remediation (NYC OER) in the "E" Designation Program to satisfy the environmental requirements imposed on the 76,400-square foot site located at 76 Eleventh Avenue (the "Site"), in New York, New York. The E-designation (E-142) applies to Hazardous Materials and Noise and was assigned on June 23, 2005 subsequent to a City Environmental Quality Review (CEQR Number 03DCP069M) as part of the West Chelsea Rezoning.

The Site was formerly enrolled in the New York State Brownfield Cleanup Program (NYSBCP) under Site No. C231036. Under the NYSBCP, the New York State Department of Environmental Conservation (NYSDEC) approved the 2011 Conceptual Remedial Action Work Plan (2011 C-RAWP) and 2012 Remedial Design (2012 RD). Pursuant to the "E" Designation, the 2011 C-RAWP and 2012 RD were submitted to the OER for review. The OER then assigned project number 13EH-N304M and issued a Notice of No Objection on July 16, 2013 to allow building permits to be issued for remediation.

Remediation was completed between October 2013 and July 2014 under the NYSDEC oversight and in accordance with the NYSDEC-approved 2012 Remedial Design. Following execution of an Environmental Easement and approval of the December 2014 Final Engineering Report (2014 FER) and Site Management Plan (2014 SMP), the NYSDEC issued a Certificate of Completion in December 2014. Upon completion of the remedy, the Site was left as a capped excavation.

The remedial action described in this document was developed in accordance with the NYSDEC-approved SMP for the proposed construction. This EECPRP provides for the protection of public health and the environment consistent with the intended property use, complies with applicable environmental standards, criteria and guidance, and conforms to applicable laws and regulations.

Site Location and Background

The 1.755-acre Site, identified as Block 689 and Lot 17 on the Manhattan Borough Tax Map, comprises the entire city block bounded by West 17th Street, West 18th Street, 10th Avenue, and Route 9A. The Site is relatively flat ranging from about elevation[1] (el.) 8 along Route 9A to about el. 10 along 10th Avenue. A Site Location Map and Site Plan are provided as Figure 1 and Figure 2, respectively.

[1] Elevations referenced herein are to the North American Vertical Datum of 1988 (NAVD 88), which is about 1.083 feet above mean sea level and about 1.669 feet below Manhattan Borough Datum.

The Site is part of the Special West Chelsea zoning district, which was created by the City of New York to provide opportunities for new residential and commercial development. In addition, the recent renovation of the High Line (a former elevated rail line constructed between 1929 and 1934) by the NYC Parks and Recreation Department into an open space is part of the West Chelsea development project. The recently opened and heavily utilized NYC High Line Park (the High Line) traverses the Site from north to south along the eastern portion of the Site near 10th Avenue.

Prior to remediation, the Site was completely paved with an asphalt surface and used as a commercial parking lot. A portion of that parking lot has been restored.

Summary of Redevelopment Plan

The proposed development is consistent with current zoning laws and the intended use of the property as commercial and residential use, in accordance with an Environmental Easement placed on the Site and Environmental Conservation Law (ECL) Article 71, Title 36. Based on available plans, the proposed development will consist of a podium and two multiple-story residential high-rise towers west of the High Line and a ground-level plaza east of the High Line. The podium, towers and plaza share a one-level basement that occupies the entire footprint of the 76,600-square-foot lot. Isolated slab-on-grade construction is proposed for some areas along the southern and western boundaries of the Site.

The two towers will require removal of the clean soil and stone cap to about ± el. 2.3 to -1.4 feet NAVD88, with deeper localized excavations in residual site soil and the ISS monolith[2] for elevator pits, pile caps, and mat foundations. The foundation construction for the two towers will consist of a 14- to 20-inch-thick concrete pressure slab for cellar levels. The plaza area, beneath and east of the High Line, will require removal of the asphalt cover and excavation to ± el. -12.5 feet NAVD88 to accommodate the basement level, containing a 20- to 28-inch-thick concrete pressure slab.

Summary of Surrounding Property

The Site is situated in the Chelsea neighborhood, generally characterized by residential, commercial, and industrial uses. The surrounding infrastructure is well established, including utilities (water, sewer, electrical, telecommunications, etc.) paved roadways, and public transportation. The High Line Park is a densely populated public walkway, which traverses the eastern part of the Site from north to south. The High Line is a public space, maintained by

[2] The ISS (in situ soil stabilization/solidification) monolith consists of cement-bentonite grout homogenized into subsurface soil to create a uniform formation having low permeability and strength between 55 psi and 140 psi.

Friends of the High Line with support from the New York City Department of Parks & Recreation, whose foundation columns and general condition must be preserved during development. In addition to the High Line, multiple restaurants, entertainment centers, and residential uses occupy the immediate surroundings of the Site.

Summary of Past Site Uses and Areas of Concern

Historical Operation and Land Use – Before Manufactured Gas Plant (MGP) Operations

The Site experienced little or no development prior to its use as an MGP, and the original shoreline of the Hudson River was at or near Tenth Avenue (in the vicinity of the Site). Once the eastern end of the block had been filled, the Manhattan Gas Light Company purchased the lots along West 18th Street and parts of 10th Avenue in 1833 from various owners. Concurrently, individuals bought lots and constructed five houses at the southeast end of the block, adjacent to the future location of the MGP facility. These houses remained until the late 1850s, when the gas company bought these lots and razed the houses to make room for additional MGP structures.

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During the nineteenth century, the West 18th Street Gas Works grew in size as the Manhattan Gas Light Company continued to purchase land and construct additional facility structures. The first property bought by the West 18th Street Gas Works was on the south side of West 18th Street, at the eastern end of Block 689. In 1858, the Manhattan Gas Light Company expanded the Retort House to include six groups of 160 retorts each, for a total of 960 retorts. To the west of the Retort House was a large coal house, where coal was stored after being unloaded from the adjacent waterfront pier. To the east of the Retort House was a laboratory along West 18th Street, and south of that, a building containing condensers, scrubbers and washers. Sanborn Maps as well as other historical maps depicting the former MGP features on Block 689 were included as appendices to the 2007 Remedial Investigation (RI) Report.

The West 18th Street Gas Works continued to operate through the final decades of the nineteenth century, although it did not acquire any additional land or change its configuration markedly during that period. The West 18th Street Gas Works appears to have operated only one or two years into the twentieth century.

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Between 1909 and 1914, the remaining gas holders used during operation of the West 18th Street Works were demolished by the Consolidated Gas Company of New York, Inc. (Consolidated Gas Company), the successor by consolidation to the Manhattan Gas Light Company. During the 1910s, the Consolidated Gas Company began to sell the properties comprising the grounds of the West 18th Street Gas Works, marking the end of the MGP history for the Site. In 1936, the Consolidated Gas Company changed its name to Consolidated Edison Company of New York, Inc.

In 1917, the Consolidated Gas Company sold the entire Block 689 to the New York State Realty and Terminal Company. From 1932 through 1960, the Site was owned by the New York Central Railroad Company and was used during this period as an active freight rail yard. Since 1960, the block has been owned by a series of realty companies and corporations. After the Consolidated Gas Company sold the Site, some of the former MGP buildings on the block were used for other purposes. The remainders of the old MGP buildings were razed after the railroad acquired the Site in 1932, and a railroad yard (with tracks) was built in their place. Later, the tracks were removed or covered and the block was used as a parking lot. In the mid-1950s, an automobile fueling and service station and garage were also built along West 17th Street, near present-day Route 9A. The buildings were demolished in the 1980s.

The section of the High Line that traverses the Site was recently renovated by the NYC Department of Parks and Recreation as an urban green space and includes public access to the park near the intersection of 10th Avenue and West 18th Street. This section of this NYC Park was opened to the public on June 9, 2009.

Summary of Work Performed

Investigations conducted at the Site include the following:

- Phase I Investigation, Melick, Tully and Associates (MTA), 1998
- Limited Phase II Environmental Site Investigation, MTA, 1998
- Geotechnical Investigation, MTA, 1998
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- Interpretive Characterization of Analytical Results, Worldwide GeoSciences, Inc., 2000
- Environmental Assessment for 17th Street Residential Project, New York, NY, Langan, 2005
- Site Characterization Study, TRC Environmental, 2006
- Geotechnical Engineering Study, 17th Street Residential High-Line Properties Development, New York, NY, Langan, 2007
- Remedial Investigation Report, West 18th Street Former Gas Works, Tax Block 689, Lot 17, Manhattan, NY, ARCADIS BBL, May 2007
- Site Wide Remedial Investigation Report, West 18th Street Former Gas Works, Manhattan, New York, ARCADIS BBL, December 2009 (2009 Site-Wide RI Report)
- West 18th Street Former Gas Works, NAPL Pilot Study Report, Arcadis of New York, May 25, 2010

More than 225 borings were completed, in addition to groundwater and soil gas investigations, during previous studies. The 2007 RI Report included descriptions of each of the earlier investigations and their associated results. A Remedial Investigation Addendum (Langan, May 2011) (2011 RI Addendum) summarized the 2007 RI Report and the 2009 Site Wide RI Report.

Summary of Findings of Remedial Investigations

General Findings

A key finding of the various studies was the extensive presence of obstructions below grade throughout the Site, including foundation walls and timber piles. In addition, obstructions that appeared to be historic pier, bulkhead structures, or cribbing were also present on the western third of the Site. The shoreline in this area changed often as a result of land reclamation projects and subsequent dredging. By 1852, the original shoreline along 10th Avenue extended west, creating two additional blocks to 13th Avenue. By the early 1900's, dredging pulled the shoreline east, cutting through the Site as the current day 11th Avenue/9A highway. Similar obstructions by bulkhead walls were encountered during excavation of neighboring projects to the north. Accordingly, the presence of below grade obstructions was considered in evaluating the potential remedial alternatives.

Subsurface Quality

Dense Non-aqueous Phase Liquid (DNAPL) coal tar was observed in several borings and accumulated in on-site monitoring and recovery wells. DNAPL was observed at depths up to 35 feet below sidewalk grade, terminating at a low-permeable silty-clay confining layer. The thickest accumulation of DNAPL occurred at an irregular depression in the confining layer at the western end of the Site. Constituents of concern, benzene, toluene, ethyl benzene, and total xylenes (BTEX) and poly cyclic aromatic hydrocarbons (PAH), commonly found in coal tar, were detected in soil and groundwater at concentrations that exceed their respective guidance standards.

Volatile organic compounds (VOC) were typically not detected at concentrations above their respective NYSDEC Restricted-Residential Use Soil Cleanup Objectives (SCO) in the near-surface soil (less than 4 feet below grade). Samples collected from the shallow fill contained VOCs and semivolatile organic compounds (SVOC) at concentrations that are typical of NYC historic fill. BTEX and SVOC concentrations were typically highest in soil samples collected below the water table, where MGP-related impacts were observed.

BTEX and several SVOCs were detected in groundwater (screened within the historic fill) at concentrations that exceed NYSDEC Class GA Ambient Water Quality Standards and Guidance Values (SGV). Groundwater samples collected from wells screened below the confining layer and the shallow historic fill layer contained concentrations of BTEX and chlorinated VOCs. Chlorinated VOCs are not typically associated with MGP sites; they are likely migrating from off-site sources. SVOCs generally were not detected in wells screened below the confining layer.

According to results of the soil gas investigation, most of the compounds detected in the nine site-wide soil vapor samples were also present in ambient air. Concentrations of VOCs in soil vapor were below NYS Department of Health Air Guideline Values.

A more detailed summary of the investigation findings is provided in Section 1.6 of this EECPRP.

Summary of the 2014 NYSDEC Remediation and Proposed Remedial Action for Construction

2014 NYSDEC Remediation

The Site was remediated in accordance with the NYSDEC-issued 2008 Decision Document and the approved 2012 Remedial Design. The Track 4 remedy, discussed in Section 3 of this EECPRP, was performed in accordance with NYSDEC Technical Guidance for Site Investigation and Remediation, dated May 3, 2010 (DER-10) and the BCP guidelines to achieve the Remedial

Action Objectives (RAO). The remedy fulfilled the Decision Document RAOs and was completed under the oversight of the NYSDEC. The remedy consisted of:

1. Excavation and off-site disposal of soil to 3 feet below grade beneath and east of the High Line and to 7 feet below grade in areas west of the High Line;
2. Installation of a subsurface containment wall that terminated into the confining silty-clay layer;
3. In-situ soil solidification/stabilization (ISS) to solidify soil to the confining silty-clay layer and limit movement of coal tar;
4. Installation of a highly-visible demarcation barrier at the base of all excavation areas, and on the top of the ISS monolith;
5. Placement of a clean backfill cap meeting the lower of the 6 NYCRR Part 375 SCOs for Restricted-Residential and Protection of Groundwater to prevent future contact with contaminated soil;
6. DNAPL recovery in the area of historic bulkheads and cribbing (i.e., where ISS was not feasible);
7. Execution and recording of an Environmental Easement to restrict land use and prevent future exposure to any residual contamination;
8. Development and implementation of a Site Management Plan for long term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) DNAPL recovery, (3) maintenance of cover system, and (4) evaluation of soil vapor intrusion and soil vapor mitigation, and (5) reporting; and
9. Periodic certification of the institutional and engineering controls listed above.

<u>Proposed Remedial Action for Construction</u>

The proposed development will have full-time occupants, requiring vapor mitigation controls for residual contaminants that remain in the subsurface. Select foundation components in the western part of the Site will require excavation and disposal of residual site soil. In the eastern part, excavation will be necessary for a planned basement. The proposed remedial action for construction will consist of:

1. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.

2. Maintenance and protection of the completed NYSBCP Track 4 site-specific remedy, identified in the 2011 C-RAWP and 2012 RD and detailed in the 2014 FER.
3. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking and staking excavation areas.
4. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
5. Excavation and removal of excess soil/fill required for development.
6. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and uncontaminated materials.
7. Transport and off-site disposal of soil/fill at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Additional sampling and analysis of excavated media as required by disposal facilities.
8. If required, import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.
9. Construction of an engineered composite cover consisting of a 12- to 14-inch thick concrete slab constructed on-grade and a 16-to 22-inch thick concrete pressure slab for below grade construction.
10. Installation of a vapor barrier system, consisting of a minimum 20-mil membrane beneath the building slab and outside of vertical subgrade foundation sidewalls to mitigate soil vapor migration into the building. All welds, seams and penetrations through the membrane will be properly sealed to prevent preferential pathways for vapor migration. The vapor barrier system is an Engineering Control for the remedial action.
11. Construction and operation of a cellar-level parking garage with high volume air exchange in conformance with NYC Building Code.
12. Administrative prerequisites of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
13. Dewatering will be in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of

Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.

14. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
15. Submission of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this EECPRP, and describes all Engineering and Institutional Controls to be implemented at the Site.
16. Conformance to the 2014 SMP and, following development, revisions to the SMP to reflect the newly constructed Engineering Controls and changes to existing Engineering Controls. The revised SMP will provide for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency.
17. The property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this EECPRP and a requirement that management of these controls must be in compliance with the NYSDEC-approved SMP. Institutional Controls are discussed in Section 4.4.

EXCAVATION AND ENGINEERING CONTROLS PROTECTION AND RESTORATION PLAN

1.0 PROJECT BACKGROUND

76 Eleventh Avenue Property Owner, LLC is working with the New York City Office of Environmental Remediation (NYC OER) in the "E" Designation Program to satisfy the environmental requirements imposed on the 76,400-square foot site located at 76 Eleventh Avenue (the "Site"), in New York, New York. The E-designation (E-142) applies to Hazardous Materials and Noise and was assigned on June 23, 2005 subsequent to a City Environmental Quality Review (CEQR Number 03DCP069M) as part of the West Chelsea Rezoning.

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1.1 Site Location and Background

The 1.755-acre Site, identified as Block 689 and Lot 17 on the Manhattan Borough Tax Map, comprises the entire city block bounded by West 17th Street, West 18th Street, 10th Avenue,

and Route 9A. The Site is relatively flat ranging from about elevation[3] (el.) 8 along Route 9A to about el. 10 along 10th Avenue. A Site Location Map and Site Plan are provided as Figure 1 and Figure 2, respectively.

The Site is part of the Special West Chelsea zoning district, which was created by the City of New York to provide opportunities for new residential and commercial development. In addition, the recent renovation of the High Line (a former elevated rail line constructed between 1929 and 1934) by the NYC Parks and Recreation Department into an open space is part of the West Chelsea development project. The recently opened and heavily utilized NYC High Line Park (the High Line) traverses the Site from north to south along the eastern portion of the Site near 10th Avenue.

Prior to remediation, the Site was completely paved with an asphalt surface and used as a commercial parking lot. A portion of that parking lot has been restored.

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The proposed development is consistent with current zoning laws and the intended use of the property as commercial and residential use, in accordance with an Environmental Easement placed on the Site and Environmental Conservation Law (ECL) Article 71, Title 36. Based on available plans, the proposed development will consist of a podium and two multiple-story residential high-rise towers west of the High Line and a ground-level plaza east of the High Line. The podium, towers and plaza share a one-level basement that occupies the entire footprint of the 76,600-square-foot lot. Isolated slab-on-grade construction is proposed for some areas along the southern and western boundaries of the Site.

The two towers will require removal of the clean soil and stone cap to about ± el. 2.3 to -1.4 feet NAVD88, with deeper localized excavations in residual site soil and the ISS monolith for elevator pits, pile caps, and mat foundations. The foundation construction for the two towers will consist of a 14- to 16-inch-thick concrete pressure slab for cellar levels. The plaza area, beneath and east of the High Line, will require removal of the asphalt cover and excavation to ± el. -12.5 feet NAVD88 to accommodate the basement level, containing a 20- to 28-inch-thick concrete pressure slab.

Proposed development plans are provided in Appendix A.

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1.3 Description of Surrounding Property

The Site is situated in the Chelsea neighborhood, generally characterized by residential, commercial, and industrial uses. The surrounding infrastructure is well established, including utilities (water, sewer, electrical, telecommunications, etc.) paved roadways, and public transportation. The High Line Park is a densely populated public walkway, which traverses the eastern part of the Site from north to south. The High Line is a public space, maintained by Friends of the High Line with support from the New York City Department of Parks & Recreation, whose foundation columns and general condition must be preserved during development. In addition to the High Line, multiple restaurants, entertainment centers, and residential uses occupy the immediate surroundings of the Site.

Properties adjacent the Site are summarized in the below table.

Location	Description
North	18th Street, IAC Building, artist gallery, commercial parking lot
East	10th Avenue, multiple restaurants and residential buildings
South	17th Street, Manhattan Mini Storage
West	11th Avenue, Pier 59 Sports Complex, Hudson River (beyond)

The surrounding land usages are shown on Figure 3.

1.4 Summary of Past Site Uses and Areas of Concern

Historical Operation and Land Use – Before Manufactured Gas Plant (MGP) Operations

The Site experienced little or no development prior to its use as an MGP, and the original shoreline of the Hudson River was at or near Tenth Avenue (in the vicinity of the Site). Once the eastern end of the block had been filled, the Manhattan Gas Light Company purchased the lots along West 18th Street and parts of 10th Avenue in 1833 from various owners. Concurrently, individuals bought lots and constructed five houses at the southeast end of the block, adjacent to the future location of the MGP facility. These houses remained until the late 1850s, when the gas company bought these lots and razed the houses to make room for additional MGP structures.

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- Environmental Assessment for 17th Street Residential Project, New York, NY, Langan, 2005
- Site Characterization Study, TRC Environmental, 2006
- Geotechnical Engineering Study, 17th Street Residential High-Line Properties Development, New York, NY, Langan, 2007
- Remedial Investigation Report, West 18th Street Former Gas Works, Tax Block 689, Lot 17, Manhattan, NY, ARCADIS BBL, May 2007
- Site Wide Remedial Investigation Report, West 18th Street Former Gas Works, Manhattan, New York, ARCADIS BBL, December 2009 (2009 Site-Wide RI Report)
- West 18th Street Former Gas Works, NAPL Pilot Study Report, Arcadis of New York, May 25, 2010

The 2007 RI Report included descriptions of each of the earlier investigations and their associated results. A Remedial Investigation Addendum (Langan, May 2011) (2011 RI Addendum) summarized the 2007 RI Report and the 2009 Site-Wide RI Report.

A key finding of the various studies was the extensive presence of obstructions below grade throughout the Site, including foundation walls and timber piles. In addition, obstructions that appeared to be historic pier, bulkhead structures, or cribbing were also present on the western third of the Site. The shoreline in this area changed often as a result of land reclamation projects and subsequent dredging. By 1852, the original shoreline along 10th Avenue extended west, creating two additional blocks to 13th Avenue. By the early 1900's, dredging pulled the shoreline east, cutting through the Site as the current day 11th Avenue/9A highway. Similar obstructions by bulkhead walls were encountered during excavation of neighboring projects to the north. Accordingly, the presence of below grade obstructions was considered in evaluating the potential remedial alternatives.

1.6 Summary of Findings of Remedial Investigations

Soil, groundwater and soil gas investigations have been completed, and were documented in the 2007 RI Report and the 2009 Site-Wide RI Report and the Remedial Investigation Addendum (Langan, May 2011). A Site characterization summary of findings from these reports is presented in the following section of this report.

1.6.1 Site Geology

Between 50 and 80 feet of unconsolidated materials overlie bedrock at the Site. Based on observations from more than 225 borings completed during previous investigations, the overburden may be divided into three distinct stratigraphic units. From the surface down, the units are:

- Fill Unit, a highly heterogeneous, generally high permeability interval that encompasses foundations, utilities, former piers and wooden cribbing
- Silty-Clay Unit, a low-permeability aquitard consisting of tidal marsh deposits
- Sand Unit, a high-permeability unit of stratified alluvial sands

These units vary in thickness across the Site and are described in further detail below.

Fill Unit

The Fill Unit is highly heterogeneous, consisting of silt, sand, gravel and boulders, along with anthropogenic materials such as brick, concrete, ash, timbers, coal, glass and metal pieces.

The unit averages 25 feet thick, but thickens below 11th Avenue to as much as 45 feet adjacent to the current Hudson River bulkhead.

The thickness of the Fill Unit most directly reflects a series of land reclamation projects completed during the 19th century. These projects included both raising the existing dry land surface to an even grade and reclaiming land from the Hudson River. There are three alignments of the Hudson waterfront that bracket three distinct regions of filling at the Site, which are reflected in subsurface data at the Site. Each region is described in more detail below.

Filling Inshore of the Predevelopment Shoreline

Prior to significant development in the Site area, the Hudson River shoreline was located east of 10th Avenue (Bridges 1814). The only portion of the Site located inshore of this line is Block 715, Lot 19, the location of remote gas holders Nos. 6 and 7. Though an 1814 map shows this location as dry land, the location is on low ground at the bottom of a bluff next to the river. The current thickness of fill on this parcel is between approximately 18 and 23 feet, extending to as much as 10 feet below sea level. Thus, the fill thickness reflects a combination of excavation (potentially for installation of the two gas holder foundations on that parcel) and additional filling to bring the ground surface to an even grade approximately 13 feet above sea level. The fill observed outside the holders on this Site is described as a mixture of silt, fine to coarse sand and gravel, with trace amounts of man-made materials such as brick and glass.

Filling Between the Predevelopment Shoreline and the 1830 Cribbing Wall

From 1828 to 1833, fill was used to extend the shoreline to a new cribbing wall bulkhead aligned north-south approximately 500 feet west of the predevelopment shoreline (Colton 1836). The area inshore of this new bulkhead includes most of the present-day Site west of 10th Avenue. The fill in this region averages approximately 25 feet thick, but varies significantly due to relief in the underlying Silty-Clay Unit surface.

The nature of the fill in this region varies considerably, often between adjacent borings, but is generally segregated in two zones:

- A shallow zone (within roughly the upper 5 or 10 feet), with a significant component of man-made materials that includes remnants of former structures and coarse debris.
- A deeper zone, typically described as a fine to medium or fine to coarse sand, with some or a little gravel and silt, but may also be dominantly fine grained sand or dominantly gravel. Materials such as wood and brick occur sporadically in this zone, but are not a significant component of the material. The basal sands of the fill have been

described as an "Upper Sand Unit" in some previous investigations, but is interpreted in the 2009 Site Wide RI Report as a sub-unit of fill. Locally, some basal portions of the sandy zone may be in situ alluvial deposits, though they are texturally indistinct from the sandy fill.

The fill thickness varies in relation to depressions in the underlying Silty-Clay Unit surface that are likely the result of erosion or excavation of the silty-clay surface prior to filling. In a few locations, the clay surface rises significantly and pinches the fill thickness to as little as 13 feet.

Filling Offshore of the 1830 Cribbing Wall

In the region west of the 1830 cribbing wall to the current bulkhead, the fill deepens westward and contains evidence of the stepwise extension of the waterfront using timber cribbing and mixed fill. The shoreline evolved quickly between approximately 1830 and 1859. The historical maps (Colton 1836 Burr 1839 Ensign 1845 Dripps 1852 and Perris 1859) cataloged in ARCADIS' 2007 RI Report show four different shoreline alignments (1836, 1839, 1845, 1852) prior to reaching a maximum in 1859. Timbers were encountered in borings at numerous locations in this region, generally associated with former waterfront alignments, cribbing, former piers and pilings, or loose timber in the fill.

The fill encountered between timbers and in borings that did not encounter timbers is extremely heterogeneous. In general, the material is dominantly sand-sized, but also includes finer materials (silt and clay pockets) and coarser materials (gravel and cobbles), particularly in the cribbing. Traces of brick, ash, wood fibers and concrete are also common in the fill. The fill deepens and thickens west of the 1830 cribbing wall, from approximately 30 feet to a maximum of approximately 45 feet along the current bulkhead.

Silty-Clay Unit

The Silty-Clay Unit underlies the fill and consists predominantly of brown, gray or black silty-clay, with occasional sand and peat lenses that contain traces of shell fragments and decayed plant material. The unit is interpreted to be a tidal marsh deposit formed on the shallow banks of the Hudson River adjacent to the predevelopment shoreline. The Silty-Clay Unit is at its thickest (approximately 40 feet) along an axis parallel to the former shoreline, between 10th and 11th Avenue. The unit appears to grade laterally into sands east of 10th Avenue, becoming interbedded with sands approaching the predevelopment shoreline. Silty-Clay Unit beds exist as far east as Block 759, Lot 59 (the former remote gas holders) where vertically disconnected clay lenses were observed in several borings. The Silty-Clay Unit is irregular with isolated depressions and high points, dips westward into the channel of the Hudson, and along the current shoreline ranges from 15 feet to over 40 feet in thickness. As further discussed below,

the Silty-Clay Unit represents a low permeability barrier between the overlying Fill Unit and the underlying Sand Unit.

Sand Unit

The Sand Unit underlies the low-permeability Silty-Clay Unit and consists of stratified layers of sand, varying in size from fine to coarse, with intervals of gravel and occasional silt or silty fine sand. Borings completed through the sand unit suggest a high degree of heterogeneity, consistent with deposition in a fluvial environment. The thickness of the Sand Unit is approximately 40 feet in the western half of Block 689 (the former gas works area). The unit thins as the underlying bedrock surface rises to the northeast and may even pinch out beneath Block 690, Lot 29 (former gas holders 4 and 5), where bedrock rises to 45 feet bgs. Along 10th Avenue and continuing to the east, the overlying Silty-Clay Unit becomes interbedded with sands and becomes texturally indistinguishable from the Sand Unit. The Sand Unit approaches 45 feet beneath Block 715, Lot 59 (former remote holders) because much of the overlying Silty-Clay Unit is absent.

Bedrock

The bedrock beneath the Site is the Cambrian Hartland Formation, which is generally described as schist. The bedrock encountered during the RI was described as gold-colored weathered schist to gray schist. The bedrock surface slopes from the northeast to the southwest. The shallowest occurrence was 45 feet bgs at Block 715 Lot 59; the deepest was 86 feet bgs at the Site.

A plan of investigation borings and geologic profiles are shown in Figures 2a and 2b of the 2014 SMP. Geologic boring data is summarized from the Arcadis 2007 RI and 2009 Site-Wide RI.

1.6.2 Site Hydrogeology

The Fill Unit, Silty-Clay Unit and Sand Unit form distinct hydrostratigraphic intervals, as discussed below:

- The saturated portion of the fill is highly heterogeneous, consisting of a variety of fill types. The fill is interpreted as a highly permeable medium, with occasional discontinuous pockets of low-permeability materials such as silt and clay. The fill is present everywhere at the Site, but is obstructed in places by barrier walls; deep utilities; and foundations, piles and sheet-piling.
- The Silty-Clay Unit is interpreted to be a low-permeability aquitard. The unit includes heterogeneity consistent with a tidal marsh deposit and thus includes discontinuous lenses of fine sand, silt and peat, within a bulk mass dominated by silty-clay. The unit is

interpreted to have little transmissivity and to restrict vertical groundwater flow. The Silty-Clay Unit is confining with respect to the underlying Sand Unit.

- The Sand Unit is a moderately permeable aquifer. The unit is a stratified system and therefore highly anisotropic. Permeability is interpreted to be greatest in the horizontal plane focused in the most coarse-grained sand or gravel beds. Interbedded fine-grained sands and silts will inhibit vertical migration.

Tidal Influences

The tides in the Hudson River have a damped influence on groundwater levels near the waterfront. During a 2-day tidal study completed in 2007, the water level oscillated over a range of 2 to 2.5 feet at two water table monitoring wells located within 50 feet of the bulkhead. The observed water table fluctuations are less than half of the full tidal range of 6 feet, recorded during this period.

Hydrographs recorded at three water table wells located between 210 and 400 feet inshore of the bulkhead showed no observable tidal influence. A muted tidal influence of approximately 0.2 feet was recorded in the Sand Unit about 210 feet inshore of the bulkhead. This existence of a tidal effect 210 feet inshore in the Sand Unit (where none is detectable in the overlying Fill Unit) provides additional evidence that the Sand Unit is confined by the overlying Silty-Clay Unit. The data suggest that tidal influences in the unconfined fill do not propagate inshore as efficiently, and that tidal energy is quickly dissipated in the adjacent aquifer. Based on the results of the tidal study, tidal influence in the water table aquifer is limited to areas adjacent to the current bulkhead. These observations are consisted with the bulkhead descriptions provided in 2009 Site Wide RI Report and the inference that the Hudson River bulkhead adjacent to the Site serves as a partially leaky barrier to groundwater flow.

Groundwater Flow

The water table at the Site occurs in the Fill Unit at an average depth of about 9 feet bgs, with from sidewalk grade. The water table is nearly flat and is encountered at an average elevation approximately equal to mean sea level. The irregularities in the surface reflect several factors:

- Tidal fluctuations in the Hudson River produce minor (2 to 2.5 feet), changes to water table elevations in the wells located immediately adjacent to the Hudson River bulkhead, with influence decreasing inshore. Though Figure 3 (included in the 2014 SMP) reflects a nearly synoptic water-level round, the temporal lag and delay of tidal effects (next to the Hudson River) is not shown.

- Leaky flow barriers, potentially including the Hudson River bulkhead, other sheet pile walls, partially penetrating utilities and holder foundations diverts movement of groundwater and may create local mounding and depressions.
- The perimeter barrier walls on Block 690, Lots 12 and 46 and Block 691, Lot 11, create no-flow zones forcing groundwater to flow around them.
- Leaking water utilities and drains may create local intermittent water table mounds. Sewers that leak may have the opposite effect.
- Potential unidentified pumping stresses, such as building dewatering systems in buildings adjacent to the Site.

Groundwater is interpreted to flow generally toward the Hudson River, though discharge to the river may occur only at mean and low tides. Actual groundwater flow paths are heavily influenced by the location, integrity and alignment of subsurface structures. The lack of a significant hydraulic gradient reflects the high permeability of the Fill Unit, and indicates generally sluggish flow.

Groundwater in the Sand Unit flows to the Hudson River. Measured water-level elevations in Sand Unit monitoring wells are typically about the same as the water table elevation (i.e. Fill Unit). Groundwater in both the Sand Unit and Fill Unit are in quasi equilibrium with the river and no significant vertical gradient exists across the Silty-Clay Unit. The Fill Unit and Sand Unit are interpreted to be hydraulically disconnected, with no exchange occurring across the Silty-Clay Unit.

1.6.3 Nature and Extent of Impacts

This section presents an overall Site characterization based on the results of the 2007 RI, and the Site Characterization Study (SCS). The Site characterization consists of a summary of the following:

- DNAPL Extent;
- Soil Quality;
- Groundwater Quality; and
- Soil Vapor Quality.

DNAPL Extent

The estimated extent of DNAPL presented in the 2007 RI Report and the 2008 AAR was enhanced by the implementation of pre-design borings that were documented in the 2009 Site Wide RI Report. The estimated extent of DNAPL is described below.

The distribution of DNAPL observed in the subsurface is shown in profile (Figure 2b of the 2014 SMP) and on a series of four diagrams (Figure 4 of the 2014 SMP), representing locations where DNAPL was observed within a specific depth interval: 0 to 10 feet, 10 to 20 feet, 20 to 30 feet and 30 to 40 feet bgs. The ground surface throughout the area is generally flat (about el. 8.5 on average); thus, each depth interval is also an approximation of an equal elevation interval. The figures show observed DNAPL saturation from blebs to "saturated." The extent of MGP-impacted soil is briefly described below:

- Oil-like material (OLM) and tar-like material (TLM) occur as discrete intervals in the subsurface at depths of less than 5 feet to approximately 35 feet bgs. The majority of saturated OLM and TLM impacts occur in the Fill Unit, between 10 and 30 feet bgs.
- OLM was more frequently observed in borings than TLM. TLM was sporadically observed throughout the Site as coatings on buried timbers or as immobile ganglia.
- OLM is present and described as "saturated" in the south-central portion of the Site, beneath the southeast corner of the former retort house, the southwest corner of the former scrubber house, the western end of the former workshops and the open areas that separated those buildings.
- The distribution of DNAPL-impacted soil at the Site is related to the top surface of the Silty-Clay Unit, indicating that the Silty-Clay Unit generally acts to limit the downward migration of DNAPL. DNAPL-impacted soil appears to be concentrated in areas where the Silty-Clay Unit is lower in elevations and/or thinner.
- The thickest accumulations of DNAPL-containing materials are found within two irregular depressions in the Silty-Clay Unit surface in the southern half of the Site. In these two regions, DNAPL saturation typically starts at 10 to 12 feet bgs and extends vertically to the surface of the Silty-Clay Unit.
- The deepest occurrences of DNAPL were observed in localized depressions where the silty-clay surface is deepest, as described below:
    - The northwest corner of the block, where the clay surface slopes toward the river to the west. In this region, DNAPL is typically characterized as TLM, found to a maximum depth of 35 feet bgs. TLM was described as saturated over a 1-foot depth interval in this area. The underlying Silty-Clay Unit is not impacted.

- OLM is present to 35 feet bg in a depression along the southern block boundary. The underlying Silty-Clay Unit is not impacted.
- A deep depression in the Silty-Clay Unit surface near the center of the Site was encountered at 43 feet bgs. OLM was detected in this boring to a depth of 35 feet bgs. The underlying Sand and Silty-Clay Units were not impacted.

· The Site-wide occurrence of the Silty-Clay Unit and the absence of TLM and OLM penetrating this unit indicates that the Silty-Clay Unit is confining to DNAPL and an effective barrier between the Fill Unit and the underlying Sand Unit.

1.6.4 Soil Quality

Analytical soil sample results presented in the site-specific 2007 RI Report were compared to the Recommended Soil Cleanup Objectives (SCOs) presented in *"Technical and Administrative Guidance Memorandum: Determination of Soil Cleanup Objectives and Cleanup Levels"* HWR 94-4046 (TAGM 4046), dated January 24, 1994 (i.e., the applicable New York State soil standards at the time that this report was written). The approximate distribution of soil containing chemical constituents at concentrations greater than the Restricted-Residential Use SCOs (i.e., current applicable New York State soil standards) is shown on Figures 5a and 5b of the 2014 SMP. A summary of soil data compiled from the 2007 RI and 2009 Site-Wide RI is presented in Table Group 1 in the 2014 SMP. Key findings based on the analytical data are presented below.

- Volatile Organic Compounds (VOCs), which were predominantly benzene, toluene, ethylbenzene, and xylene (BTEX), were generally detected at concentrations above the Restricted Residential Use SCOs in soil samples that were collected from below the water table and that also exhibited field evidence of MGP-related impacts. VOCs were typically not detected at concentrations above their respective Restricted Residential Use SCOs in the near-surface soil (i.e., less than 4 feet bgs).
- SVOCs were detected throughout the soil column above the low-permeability Silty-Clay Unit. However, the highest concentrations were detected in samples that were collected from below the water table and that contained field evidence of MGP-related impacts. Shallow fill (i.e., less than 4 feet bgs) samples that contained SVOC concentrations above their Restricted Residential Use SCOs did not exhibit MGP-related impacts and contained SVOC concentrations consistent with that of historic fill in New York City.

- Inorganics were detected in all soil samples and are generally attributed to the ambient soil quality of the historic fill. Cyanide detected in select soil samples may be attributed to historic MGP operations.
- The overall prevalence and relative concentrations of the SVOCs and inorganics detected in the upper soil horizons (e.g., Fill Unit) and in those samples where no physical evidence of impacts were observed are consistent with SVOC and metals concentrations detected in undifferentiated historic fill.
- Historic subsurface obstructions were noted throughout the Site. Obstructions in deeper soil are primarily related to cribbing and former bulkheads in the western third of the Site.

1.6.5 Groundwater Quality

Presented below is a discussion of overall groundwater quality based on the results of the monitoring activities that were conducted as part of the 2007 RI. The groundwater table occurs within the Fill Unit at a depth of about 8 to 10 feet bgs from the original asphalt, prior to remediation. Groundwater data was compared to Class GA (drinking water) criteria as presented in the NYSDEC Technical and Operational Guidance Series (TOGS) 1.1.1 Ambient Water Quality Standards and Guidance Values (SGVs).

<u>VOCs</u>

- As presented in the 2007 RI Report, 12 VOCs were detected in at least one of the nine groundwater samples. Of the 12 detected compounds, six were reported at concentrations that exceeded the NYS Class GA SGVs. VOCs detected in wells screened in the Historic Fill included BTEX compounds, cis-1,2-dichloroethene, and isopropylbenzene.
- Samples collected from wells screened in the Lower Sand Unit contained trichloroethylene (TCE) and cis-1,2-dichloroethene (DCE) in addition to BTEX and isopropylbenzene. TCE was detected at three locations within the Lower Sand Unit at concentrations above its Class GA SGVs, with a maximum detected concentration of 8.8 micrograms/liter (μg/l). In addition, cis-1,2-dichloroethene (DCE) was detected at two locations at concentrations above its Class GA SGVs, with a maximum detected concentration of 8.3 μg/l. TCE and DCE are not associated with historic MGP site operations and could be attributed to unknown off-site sources. TCE was not detected in any of the soil samples collected during the 2007 RI at concentrations above associated Restricted Residential Use SCOs, and was only detected in two soil samples

with a maximum concentration of 0.00053 milligrams per kilogram (mg/kg). TCE and DCE are not part of the target VOC list for soil.

SVOCs

A total of 20 SVOCs were detected in at least one of the nine groundwater samples. Of the 20 detected SVOCs, 11 were reported at concentrations that exceeded the TOGS Class GA criteria. Of the 20 SVOCs detected, only two were detected in groundwater within the Lower Sand Unit at concentrations that exceeded the Class GA criteria.

The SVOCs detected at the highest concentrations in groundwater included naphthalene (1,500 μg/L) and 2,4-dimethylphenol (940 μg/L). The remaining compounds detected above criteria were detected only slightly above their respective criteria.

Inorganic Analytes

As presented in the 2007 RI Report, six metals and cyanide (total and amenable) were detected in groundwater. All detected analytes were below the NYSDEC Class GA SGVs.

A summary of groundwater sample results are compiled in Table Group 2, included in the 2014 SMP. The location of groundwater samples collected and a summary of the results is presented in Figure 6 of the 2014 SMP.

1.6.6 Soil Vapor Quality

A soil vapor survey was conducted by ARCADIS BBL in 2007; the results of which are presented in the 2009 Site Wide RI Report. A total of nine soil vapor samples and two ambient air samples were collected during the survey. Table Group 3 of the 2014 SMP presents the results of the soil vapor survey. The results suggest that most of the compounds detected in soil vapor were also present in ambient air.

For more detailed results, consult the 2007 RI Report and the 2009 Site Wide RI Report.

2.0 REMEDIAL ACTION OBJECTIVES

Remedial action objectives (RAOs) were developed in collaboration with the NYSDEC for the BCP by evaluating the results of the 2007 RI and 2009 Site Wide RI Report, potential receptor populations, and proposed future use of the Site after remediation. Developing site-specific RAOs allowed for protection of the public health and environment by specifying constituents of concern (COC) to be remediated and offering achievable cleanup goals. The identified COCs consist of the VOCs benzene, toluene, ethyl benzene, and total xylenes (BTEX); and total polycyclic aromatic hydrocarbons (PAHs), as defined by the U.S. Environmental Protection Agency and Agency for Toxic Substances and Diseases Registry. The RAOs established for remediation goals and approved by the NYSDEC are presented below.

Soil RAOs

- Minimize potential risks to current and future Site occupants;
- Minimize potential off-site migration of DNAPL to the extent possible; and
- Prevent inhalation of or exposure to contaminants volatilizing from the soil.

Groundwater RAOs

- Minimize contact with or ingestion of impacted groundwater to the extent practical; and
- Minimize future impacts to groundwater and reduce concentrations of COCs in groundwater to the extent practical.

3.0 REMEDIAL ALTERNATIVES ANALYSIS

The goal of the remedy selection process is to select a remedy that is protective of human health and the environment, taking into consideration the current, intended, and reasonably anticipated future use of the property. The remedy selection process begins by establishing RAOs for media in which chemical constituents were found to exceed applicable standards, criteria and guidance values (SCGs).

Several remedial alternatives and technologies were evaluated in the 2008 AAR and discussed in the 2011 Alternatives Analysis and C-RAWP to determine the most viable remedial option that satisfies the RAOs. The remedial alternatives were developed and evaluated based on the following criteria:

- Protection of human health and the environment;
- Compliance with SCGs;
- Short-term effectiveness and impacts;
- Long-term effectiveness and permanence;
- Reduction of toxicity, mobility, or volume of contaminated material;
- Implementability;
- Cost effectiveness;
- Community acceptance; and
- Land use.

Based on the available technologies and the site constraints, the following remedial alternatives capable of mitigating the identified environmental impacts were considered:

- no action
- capping with Institutional and Engineering Controls
- containment barrier wall
- in situ soil stabilization (ISS) of NAPL-impacted soil
- ISS of NAPL-impacted soil and soil containing PAH greater than 500 parts per million (ppm)
- removal of NAPL-impacted soil and soil containing PAHs greater than 500 ppm with off-site treatment/disposal

- NAPL recovery
- in situ chemical oxidation

No individual alternative was capable of achieving the RAOs. Therefore, a combination of alternatives were developed that could address specific contaminated areas or media to achieve a Track 4 remedy. DNAPL recovery, a Site cover, a containment wall, and in situ stabilization were selected as the remedy, which was accepted by the NYSDEC in their 2008 Decision Document.

3.1 Summary of the Remedy

The Site was remediated in accordance with the NYSDEC-issued 2008 Decision Document and the approved 2012 Remedial Design. The Track 4 remedy, introduced in Section 3.0, was performed in accordance with NYSDEC Technical Guidance for Site Investigation and Remediation, dated May 3, 2010 (DER-10) and the BCP guidelines to achieve the RAOs. The remedy fulfilled the Decision Document RAOs and was completed under the oversight of the NYSDEC. The remedy consisted of:

10. Excavation and off-site disposal of soil to 3 feet below grade beneath and east of the High Line and to 7 feet below grade in areas west of the High Line;
11. Installation of a subsurface containment wall that terminated into the confining silty-clay layer;
12. In-situ soil solidification/stabilization (ISS) to solidify soil to the confining silty-clay layer and limit movement of coal tar;
13. Installation of a highly-visible demarcation barrier at the base of all excavation areas, and on the top of the ISS monolith;
14. Placement of a clean backfill cap meeting the lower of the 6 NYCRR Part 375 SCOs for Restricted-Residential and Protection of Groundwater to prevent future contact with contaminated soil;
15. DNAPL recovery in the area of historic bulkheads and cribbing (i.e., where ISS was not feasible);
16. Execution and recording of an Environmental Easement to restrict land use and prevent future exposure to any residual contamination;
17. Development and implementation of a Site Management Plan for long term management of remaining contamination as required by the Environmental Easement, which includes plans for: (1) Institutional and Engineering Controls, (2) DNAPL recovery,

(3) maintenance of cover system, and (4) evaluation of soil vapor intrusion and soil vapor mitigation, and (5) reporting; and

18. Periodic certification of the institutional and engineering controls listed above.

For technical descriptions, additional details, and supporting documentation of the completed remediation, consult the 2014 Site Management Plan and Final Engineering Report. The completed remediation and engineering controls are depicted on Figure 4. A summary of the remedy is provided in the following sections.

3.1.1 Contaminated Materials Removal

Solid Waste/Soil/Fill

All excavated material was handled as a regulated solid waste and disposed in accordance with 6 NYCRR Part 360 for regulated solid waste management facilities. No material originating from the subsurface was reused onsite. Solid waste was transported for off-site disposal in accordance with 6 NYCRR Part 364 waste transporter permits and applicable federal, state, and local laws. Vehicles hauling impacted materials were appropriately lined along the bottom, sides and tailgate with a minimum 6-mil polyethylene sheeting, and extended over the crown of each load.

About 2,735 tons of solid waste was removed from the 3-foot excavation area beneath and east of the High Line between November 8 and 26, 2013. Fixed concrete and brick structures and abandoned piping encountered were left in place because they were below the extent of the excavation limit and there were concerns of damaging the High Line foundation during extraction.

About 30,194 tons of solid waste was removed from the 7-foot excavation area west of the High Line between January 14 and July 1, 2014. In addition to removing soil and historic fill, remnant MGP structures including large brick foundations and pads and a network of abandoned piping were removed.

The excavation area is shown in plan and section view on Figure 3 of the 2014 FER.

Underground Storage Tanks

Eight USTs containing a mixture of gasoline and water were discovered at the western end of the Site near Highway 9A, in the area of the former gasoline filling station. All eight tanks were encased in concrete and observed in good condition with no noticeable punctures or routes for potential leaks or spills. Between February 7 and February 18, 2014, an FDNY-certified subcontractor vacuumed about 3,201 gallons of the tank contents, cut, cleaned residual sludge,

and containerized solid contents. The eight UTSs were appropriately closed with the NYSDEC, including the completion of all Petroleum Bulk Storage (PBS) application forms and fees; they were removed as scrap metal on February 20, 2014. The approximate locations of the eight USTs are shown on Drawing 5 in Appendix L of the 2014 FER.

3.1.2 Containment Wall

An impermeable containment wall was constructed in the western part of the Site to limit lateral migration of DNAPL and contaminated groundwater from the Site. Before installing the wall, pre-trenching was completed up to 15 feet bgs along the wall alignment to manually remove obstructions (former foundation structures, timber cribbing, and boulders) associated with former MGP operations and the changing shoreline.

The containment wall is constructed of 105 PZC-13 sheet piles with lengths varying between 20 feet and 45 feet, according to the depth of the silty-clay confining layer. The sheets are coated with an 18-mil fusion-bonded epoxy for added impermeability and corrosion protection. The sheets, as delivered, are paired at the seam by a continuous structural weld. The remaining seams adjoined during the driving process were sealed using a water-stop material capable of expanding up to 200% in volume upon contact with water.

Each sheet pair was installed to their respective depths with a maximum 2-foot embedment into the silty-clay layer. After installation, a 4,000-pound-per-square-inch strength concrete cap was cast in-place to mitigate vertical settlement of the containment wall structure. The containment wall encloses an area of about 20,120 square feet and has an estimated lateral length of about 490 feet around the western perimeter of the Site. The extent of the containment wall is shown on Figure 6 of the 2014 FER.

3.1.3 In Situ Soil Stabilization/Solidification (ISS)

ISS treatment technology was implemented to permanently immobilize contaminants in a soil-cement matrix, mitigating contaminant migration. A treatability study was performed using various blends of cement, bentonite, and blast furnace slag, of which a cement-bentonite blend was selected for field demonstration in February 2014. Based on favorable results of the field demonstration, a grout reagent consisting of 65% water, 33% cement, and 2% bentonite (by volume) was used to produce an ISS monolith with an unconfined compressive strength between 50 psi and 150 psi, and a hydraulic conductivity near 10^{-6} centimeter per second or lower.

A series of 320 overlapping cells with general dimensions 5 feet by 15 feet were homogenized, creating a relatively impermeable grout monolith. The seam between the containment wall and

the ISS was sealed by driving the end-pair sheet through the adjoining ISS cell, which allowed the grout to cure to the sheet pile. The ISS monolith, completed between March 5 and May 8, 2014, consumed nearly 1.06 million gallons of the grout reagent. The ISS area and locations where end-pair sheets tie into the ISS are shown on Figure 6 of the 2014 FER.

3.1.4 Remaining Contamination and Demarcation Barrier

Documentation Sampling

Documentation soil samples were collected every 30 linear feet along the sidewall base and every 900 square feet of bottom excavation to provide a measure of the soil quality achieved by the remedy. A total of 96 documentation samples were collected in accordance with NYSDEC DER-10. The results were compared to NYSDEC SCOs for Unrestricted and Restricted-Residential Use, and Protection of Groundwater. Sample results are summarized in Tables 3, 4a, and 4b – included in the 2014 FER. BTEX concentrations exceeding the SCOs are generally localized in the western third of the Site, near the subsurface cribbing and bulkhead structures. Remaining contamination in the east of the Site generally consists of metals concentrations above the SCOs, including lead, mercury, copper, and zinc. Figures 4a and 4b provide general locations of residual contamination.

Demarcation Barrier

Excavation of historic fill and contaminated materials terminated between 3 feet and 7 feet bgs. A demarcation barrier was installed at the interface of the remediated areas of the Site using highly-visible polyethylene orange snow fence, which extending along the top of excavation and the ISS monolith areas at the interface between the clean backfill cover.

3.1.5 Clean Backfill Cap

Exposure to remaining contamination at the Site is prevented by a soil cover system. This cover system is comprised of a minimum clean, compacted soil cap of 48 inches above the ISS treatment area, and 24 inches everywhere else. The eastern portion of the Site was restored with asphalt pavement for use as a parking lot. The locations of each cover type and details for their typical construction (including demarcation barrier placement) are shown on Figure 5 of the 2014 FER.

Roughly 15,100 cubic yards of clean backfill, meeting NYSDEC SCOs for Restricted-Residential and Protection of Groundwater was imported and placed. In addition to the minimum clean backfill cap, a filter fabric and 6-inch layer of stone cover was placed for all unpaved areas west of the High Line. These additional measures were implemented to ensure the remedial cover

system is protected from wind and rain erosion, future vehicle traffic, and to prevent dust generation in the interim before development begins.

3.1.6 DNAPL Recovery

Thirteen DNAPL recovery wells (RW-A through RW-H) had been installed in the western part of the Site, in the approximate area of historical cribbing where DNAPL was observed in soil borings. Before remediation, DNAPL recovery was performed by manual bailing or automated pumping. Between December 2008 and December 2013, about 97 gallons of DNAPL had been recovered, indicating that neither method was a viable extraction option. Following remediation, nine recovery wells – where poor DNAPL recharge was documented – were decommissioned in accordance with NYSDEC Policy CP-43. Four Recovery wells (RW-D, -E, -J, and -K) remain active to continue recovery efforts until the NYSDEC approves its discontinuance. The location of the active recovery wells and their typical construction are shown on Figure 6 of the 2014 FER.

3.1.7 Closeout Documentation

In accordance with the policies of the BCP, monitoring and protection requirements for Engineering and Institutional Controls were documented in the 2014 SMP for long-term effectiveness of the remediation. In conjunction with the SMP, an Environmental Easement was executed by the NYSDEC on October 17, 2014 and filed with the New York County Clerk on December 3, 2014 (Filling No. 2014000399345). The Environmental Easement is a legal document that enforces conformance to the Institutional Controls and requirements set forth in the SMP.

The 2014 Final Engineering Report documents the remediation in full technical detail and provides certification that the remediation satisfies the remedial requirements established in the 2011 C-RAWP and 2012 RD for a Track 4 cleanup.

4.0 EXCAVATION AND ENGINEERING CONTROLS PROTECTION AND RESTORATION PLAN FOR CONSTRUCTION

The Site received its 2014 COC from the NYSDEC for a Track 4 remedy under the NYSBCP, indicating that, in its current condition, the ECs and ICs are effective in both the short-term and long-term and reduce the mobility, toxicity and volume of contaminants and are protective of human health and the environment. During development, the remedial cap and other ECs will be disturbed and will require conformance to the SMP and Excavation Work Plan (EWP) to be restored to an equally effective condition.

The proposed development will have full-time occupants, requiring vapor mitigation controls for residual contaminants that remain in the subsurface. Select foundation components in the western part of the Site will require excavation and disposal of residual site soil. In the eastern part, excavation will be necessary for a planned basement. The proposed remedial action for construction will consist of:

1. Performance of a Community Air Monitoring Program for particulates and volatile organic carbon compounds.
2. Maintenance and protection of the completed NYSBCP Track 4 site-specific remedy, identified in the 2011 C-RAWP and 2012 RD and detailed in the 2014 FER.
3. Site mobilization involving Site security setup, equipment mobilization, utility mark outs and marking and staking excavation areas.
4. Completion of a Waste Characterization Study prior to excavation activities. Waste characterization soil samples will be collected at a frequency dictated by disposal facility(s).
5. Excavation and removal of excess soil/fill required for development.
6. Management of excavated materials including temporarily stockpiling and segregating in accordance with defined material types and to prevent co-mingling of contaminated material and uncontaminated materials.
7. Transport and off-site disposal of soil/fill at licensed or permitted facilities in accordance with applicable laws and regulations for handling, transport, and disposal, and this plan. Additional sampling and analysis of excavated media as required by disposal facilities.
8. If required, import of materials to be used for backfill and cover in compliance with this plan and in accordance with applicable laws and regulations.

9. Construction of an engineered composite cover consisting of a 12- to 14-inch thick concrete slab constructed on-grade and a 16-to 22-inch thick concrete pressure slab for below grade construction.
10. Installation of a vapor barrier system, consisting of a minimum 20-mil membrane beneath the building slab and outside of vertical subgrade foundation sidewalls to mitigate soil vapor migration into the building. All welds, seams and penetrations through the membrane will be properly sealed to prevent preferential pathways for vapor migration. The vapor barrier system is an Engineering Control for the remedial action.
11. Construction and operation of a cellar-level parking garage with high volume air exchange in conformance with NYC Building Code.
12. Administrative prerequisites of all activities required for the remedial action, including acquisition of required permits and attainment of pretreatment requirements, in compliance with applicable laws and regulations.
13. Dewatering will be in compliance with city, state, and federal laws and regulations. Extracted groundwater will either be containerized for off-site licensed or permitted disposal or will be treated under a permit from New York City Department of Environmental Protection (NYCDEP) to meet pretreatment requirements prior to discharge to the sewer system.
14. Implementation of storm-water pollution prevention measures in compliance with applicable laws and regulations.
15. Submission of a Remedial Action Report (RAR) that describes the remedial activities, certifies that the remedial requirements have been achieved, defines the Site boundaries, lists any changes from this EECPRP, and describes all Engineering and Institutional Controls to be implemented at the Site.
16. Conformance to the 2014 SMP and, following development, revisions to the SMP to reflect the newly constructed Engineering Controls and changes to existing Engineering Controls. The revised SMP will provide for long-term management of residual contamination, including plans for operation, maintenance, monitoring, inspection and certification of Engineering and Institutional Controls and reporting at a specified frequency. Per the 2014 SMP, DNAPL recovery will continue under the oversight of NYSDEC. DNAPL recovery activities may be altered or terminated following NYSDEC's approval.
17. The property will continue to be registered with an E-Designation at the NYC Buildings Department. Establishment of Engineering Controls and Institutional Controls in this

EECPRP and a requirement that management of these controls must be in compliance with the NYSDEC-approved SMP. Institutional Controls are discussed in Section 4.4.

4.1 Soil/Fill Management

Management of contaminated materials, including excavation, handling and disposal, will be conducted in accordance with the Soil/Materials Management Plan in Appendix B. Although not expected, discrete contaminant sources (such as hotspots) newly identified during construction will be located by GPS or surveyed. This information will be provided in the RAR.

4.1.1 Soil/Fill Excavation and Removal

Removal of the 6-inch stone layer and 2- to 4-foot imported clean fill, placed during the 2014 remediation, will be required in the west part of the Site to accommodate the building's foundation, with localized excavations (up to 10 feet below grade; ± el. -11 NAVD88) for elevator pits, mat foundation pile caps. In addition to soil/fill, a portion of the ISS will be removed, which will be in accordance with the NYSDEC-approved SMP and construction specifications. The area beneath and east of the High Line will require a "bathtub" excavation to about 17 feet below grade (± el. -8, with localized deeper excavations (up to 21 feet below grade; ± el. -12 feet NAVD88) for elevator pits and foundation pile caps. The location of planned excavations is shown on Figure 5.

The quantity of soil/fill expected to be excavated is about 52,500 tons, of which about 25,000 tons is clean backfill cover. As long as it does not become co-mingled with contaminated material, the clean backfill cover material may be reused onsite as general backfill. For each disposal facility, a letter from the developer/QEP to the receiving facility requesting approval for disposal and a letter back to the developer/QEP providing approval for disposal will be submitted to the NYSDEC and OER prior to any transport and disposal of soil at a facility.

Disposal facilities will be reported to the NYSDEC and OER when they are identified and prior to the start of remedial action.

4.1.2 Import of Soils

Soil import is not anticipated because of the quantity of clean backfill that constitutes the Site cover, which can be reused for general backfill. If required, import of soils onto the property will be performed in conformance with the Soil/Materials Management Plan in Appendix B, and will meet the lower of:

- 6 NYCRR Part 375 Restricted Use Restricted-Residential SCOs, and

- 6 NYCRR Part 375 Restricted Use Protection of Groundwater SCOs.

Because the need for or location of imported soil is not yet known, the quantity cannot be estimated at this time. Any imported material will be preapproved by the NYSDEC, documented during construction, and reported in the RAR.

4.1.3 Reuse of Onsite Soils

If required, reuse of the NYSDEC-approved clean soil cover is permitted, provided that procedures are in conformance with the Soil/Materials Management Plan in Appendix B. Clean soil cover material intended for on-site reuse must be properly segregated from in situ soil. Clean soil cover material that is comingled with contaminated in situ material is prohibited from being reused on Site.

4.2 Engineering Controls

Engineering Controls will be employed in the remedial action to address residual contamination remaining at the Site. The Site has the six primary Engineering Control Systems:

- Composite Cover System
- Soil Vapor Barrier System
- Subgrade ventilated garage

The following Engineering Controls were implemented during the 2014 remediation:

- In situ Soil Stabilization/Solidification (ISS)
- Containment Wall
- DNAPL Recovery

The future Engineering Controls and DNAPL recovery are described in the below sections. For details about ISS and containment wall controls, refer to the 2014 SMP and FER.

4.2.1 Composite Cover System

Exposure to residual soil/fill will be prevented by an engineered, composite cover system, consisting of:

- a 12- to 14-inch thick concrete slab for on-grade foundation construction areas, and
- a 16- to 22-inch thick concrete pressure slab for below grade foundation construction.

The typical construction type for the remedial cover system is shown in plan and in section (detail) on Figure 6.

The composite cover system will be a permanent engineering control to be inspected and its performance annually certified as required by this EECPRP and the SMP. A Soil and Materials Management Plan will be included in the SMP and will outline the procedures to be followed in the event that the composite cover system and underlying residual soil/fill is disturbed after the remedial action is complete. Maintenance of this composite cover system will be described in the revised SMP, which will be prepared following construction.

4.2.2 Vapor Barrier System

Migration of soil vapor from on-site or off-site sources into the building will be mitigated with a combination of the building concrete foundation slab and waterproofing/vapor barrier membrane, which will be installed between the concrete slab (including elevator pits and footings) and underlying subgrade layer and along subsurface building walls from the base of the excavation to surface grade level.

The membrane will be constructed using the Grace Construction and Packaging family of products, including Preprufe® 300R (46 mils) for horizontal applications and Grace Bituthene® 4000 (62 mils) and Preprufe® 160R (31 mils) along vertical applications. The waterproofing/vapor barrier membrane will be installed as a continuous layer across the building footprint. Utility and foundation penetrations and incidental punctures will be appropriately sealed in accordance with manufacture's specifications. If an alternate product is selected after approval of this EECPRP, the specifications for the alternate product will be provided to the NYSDEC for review and approval.

A plan view showing the location and extent of the proposed vapor barrier system and typical design sections is provided in Figure 7. Product specification sheets are provided in Appendix C. The RAR will include as-built drawings and diagrams and photographs of the installed system.

The Vapor Barrier System is a permanent engineering control and will be inspected and its performance annually certified as required by this EECPRP and the SMP. A Soil and Materials Management Plan will be included in the SMP and will outline the procedures to be followed in the event that the composite cover system and underlying vapor barrier system is disturbed after construction is complete. Maintenance of these systems will be described in the revised SMP.

4.2.3 Subgrade Ventilated Garage

Migration of potential soil vapor into the building will be mitigated by a combination of the vapor barrier system and the ventilated parking garage. The parking garage will exchange air at a rate compliant with NYC Building Code.

The parking garage ventilation system is considered an engineering control. The system will be inspected and its performance annually certified as required by this EECPRP and the SMP. Required maintenance will be performed by building personnel.

4.2.4 DNAPL Recovery

DNAPL recovery continues from four on-site recovery wells. Prior to extraction, each well is gauged for product thickness and then receives a steel bailer. The bailers remain undisturbed for about a two-week period to allow DNAPL to collect. The bailers are then pulled and the volume of DNAPL measured. After extraction, each bailer is cleaned and stored in polyethylene sheeting until the next monthly event. DNAPL recovery will continue until termination is approved by the NYSDEC.

4.4 Institutional Controls

Institutional Controls (IC) were established for this Site under the NYSBCP to (1) implement, maintain and monitor Engineering Control systems; (2) prevent future exposure to remaining contamination by controlling disturbances of the remaining Site contamination; and, (3) limit the use and development of the Site to Restricted-Residential uses only. Adherence to these Institutional Controls on the Site is required by the Environmental Easement and will be implemented under the NYSDEC-approved SMP. These ICs include:

- Compliance with the Environmental Easement and the SMP by the Grantor and the Grantor's successors and assigns;
- All Engineering Controls must be operated and maintained as specified in the SMP;
- All Engineering Controls on the Controlled Site must be inspected at a frequency and in a manner defined in the SMP.
- Data and information pertinent to Site Management of the Controlled Site must be reported at the frequency and in a manner defined in the SMP;
- The Site may only be used for restricted-residential, commercial, and industrial use as defined by Part 375-1.8(g), provided that the long-term Engineering and Institutional Controls included in the SMP are employed.

- The Site may not be used for a higher level of use, such as unrestricted use without additional remediation and amendment of the Environmental Easement, as approved by the NYSDEC;
- All future activities on the Site that will disturb residual MGP-impacted material must be conducted in accordance with the SMP;
- The use of the groundwater underlying the Site is prohibited without treatment as determined by the NYSDOH or NYCDOH;
- The potential for vapor intrusion must be evaluated for any buildings developed, and any potential impacts that are identified must be monitored or mitigated;
- Vegetable gardens and farming on the Site are prohibited;
- The Site owner or remedial party will submit to NYSDEC a written statement that certifies, under penalty of perjury, that: (1) controls employed at the Controlled Property are unchanged from the previous certification or that any changes to the controls were approved by the NYSDEC; and, (2) nothing has occurred that impairs the ability of the controls to protect public health and environment or that constitute a violation or failure to comply with the SMP. NYSDEC retains the right to access the Controlled Property at any time in order to evaluate the continued maintenance of any and all controls. This certification shall be submitted annually, or an alternate period of time that NYSDEC may allow and will be made by an expert that the NYSDEC finds acceptable.

Institutional Controls identified in the Environmental Easement may not be discontinued without an amendment to or extinguishment of the Environmental Easement.

The following Institutional Control will be added to the revised NYSDEC SMP:

- Continued registration of the E-Designation (E-142) for the property. This EECPRP includes a description of all ECs and ICs and summarizes the requirements of the NYSDEC-approved SMP which will note that the property owner and property owner's successors and assigns must comply with the approved SMP.

4.5 Site Management Plan

A Site Management Plan was approved by the NYSDEC in December 2014 following completion of the BCP remediation. The SMP describes the appropriate methods and procedures for monitoring and maintenance of all ECs and ICs to ensure the Site remedy remains protective of human health and the environment. The property owner is responsible to ensure that all Site Management responsibilities defined in the SMP are implemented. Site Management continues until termination is approved in writing by the NYSDEC.

The SMP contains detailed descriptions of the procedures required to manage residual soil/fill left in-place following completion of the 2014 remedial action. The 2014 SMP will be amended to include monitoring and maintenance procedures for vapor mitigation controls that will be incorporated with the proposed residential development.

5.0 REMEDIAL ACTION MANAGEMENT

5.1 Project Organization and Oversight

Principal personnel who will participate in implementing this EECPRP during construction include Steven Ciambruschini, Gerald Nicholls and Albert Tashji. The Professional Engineer (PE) for this project will be Satyajit A. Vaidya.

5.2 Site Security

Site access will be controlled by an 8-foot tall wooden construction fence with secured, locking entrances with 24/7 security. Access will be restricted to construction workers, project team members, and approved visitors.

5.3 Work Hours

The hours for operation will comply with the NYC Department of Buildings construction code requirements or according to specific variances issued by that agency. The anticipated hours of operation will be conveyed to the NYSDEC during the pre-construction meeting.

5.4 Construction Health and Safety Plan

The Health and Safety Plan is included in Appendix D. The Site Safety Coordinator will be Bill Bohrer and the Site Safety Officer will be Albert Tashji. Construction work performed under this EECPRP will be in full compliance with applicable health and safety laws and regulations, including Site and OSHA worker safety requirements and HAZWOPER requirements. Confined space entry, if any, will comply with OSHA requirements and industry standards and will address potential risks. The parties performing the construction work will ensure that performance of work is in compliance with the HASP and applicable laws and regulations. The HASP pertains to remedial and invasive work performed at the Site until the issuance of the Notice of Satisfaction.

Because the Site contains residual contamination, all field personnel involved in remedial activities will participate in training required by 29 CFR 1910.120, such as 40-hour hazardous waste operator training and annual 8-hour refresher training. Site Safety Officer will be responsible for maintaining workers training records.

Personnel entering any exclusion zone will be trained in the provisions of the HASP and will comply with all requirements of 29 CFR 1910.120. Site-specific training will be provided to field personnel. Additional safety training may be added depending on the tasks performed. Emergency telephone numbers will be posted at the Site location before any construction work begins. A safety meeting will be conducted before each shift begins to discuss task hazards and protective measures (physical, chemical, environmental), emergency procedures, PPE levels, and other relevant safety topics. Meetings will be documented in a log book or specific form.

An emergency contact sheet with names and phone numbers is included in the CHASP. That document defines the project contacts for use in case of emergency.

5.5 Community Air Monitoring Plan

Real-time continuous air monitoring for VOCs and particulates at the perimeter of the exclusion zone or work area will be performed for ground intrusive activities and during handling of contaminated or potentially contaminated media. Ground intrusive activities include, but are not limited to, soil/fill excavation and handling, test pit excavation or trenching, and the installation of soil borings or monitoring wells. Action levels that are triggered during performance of the Community Air Monitoring Plan (CAMP) will be reported to the NYSDEC and OER Project Managers and included in the Daily Report.

5.5.1 VOC Monitoring, Response Levels, and Actions

VOCs will be monitored at the downwind perimeter of the immediate work area (i.e., the exclusion zone) on a continuous basis during invasive work. Upwind concentrations will be measured at the start of each workday and periodically thereafter to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated daily before the beginning of the work shift. The equipment will be capable of calculating 15-minute running average concentrations, which will be compared to the levels specified below:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area or exclusion zone exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter of the work area or exclusion zone persist at levels in excess of 5 ppm over 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 exclusion 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 over background for the 15-minute average.

- If the organic vapor level is above 25 ppm at the perimeter of the work area, activities will be shut down.

All 15-minute readings must be recorded and be available for NYSDEC and OER personnel to review. Instantaneous readings, if any, used for decision purposes will also be recorded.

5.5.2 Particulate Monitoring, Response Levels, and Actions

Particulate concentrations will be monitored continuously at the upwind and downwind perimeters of the exclusion zone at temporary particulate monitoring stations, based on wind direction. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers in size (PM-10) and capable of integrating over a period of 15 minutes (or less) for comparison to the airborne particulate action level. The equipment will be equipped with an audible alarm to indicate when an action level has been triggered. In addition, fugitive dust migration should be visually assessed during all work activities. The action levels and procedures to be followed are specified below:

- If the downwind PM-10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM-10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind level and that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM-10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work will be stopped and reevaluated. Work will resume provided that dust suppression measures and other controls are successful in reducing the downwind PM-10 particulate concentration to within 150 $\mu g/m^3$ of the upwind level and in preventing visible dust migration.

All readings will be recorded and be available for NYSDEC and OER personnel to review.

5.6 Agency Approvals

All permits or government approvals required for construction have been or will be obtained prior to the start of work. Approval of this EECPRP by NYSDEC and OER does not constitute satisfaction of these requirements and will not be a substitute for any required permit.

5.7 Site Preparation

5.7.1 Pre-Construction Meeting

Prior to construction, NYSDEC and OER personnel will be invited to attend the preconstruction meeting at the Site with all parties involved (e.g., owner, contractor, construction manager, consultant).

5.7.2 Mobilization

Mobilization will be conducted as necessary for each phase of work at the Site. Mobilization includes field personnel orientation, equipment mobilization, and marking/staking utility mark-outs. Each field team member will attend an orientation meeting to become familiar with the general operation of the Site, health and safety requirements, and field procedures.

5.7.3 Utility Marker Layouts, Easement Layouts

The presence of utilities and easements on the Site will be fully investigated prior to the performance of invasive work such as excavation or drilling under this plan by using, at a minimum, the One-Call System (811). Underground utilities may pose an electrocution, explosion, or other hazard during excavation or drilling activities. All invasive activities will be performed in compliance with applicable laws and regulations, including NYC Building Code, to assure safety. Utility companies and other responsible authorities will be contacted to locate and mark the locations, and a copy of the Mark-Out Ticket will be retained by the contractor prior to the start of drilling, excavation or other invasive subsurface operations. Overhead utilities may also be present within the anticipated work zones. Electrical hazards associated with drilling in the vicinity of overhead utilities will be prevented by maintaining a safe distance between overhead power lines and drill rig masts.

Proper safety and protective measures pertaining to utilities and easements, and compliance with all laws and regulations will be employed during invasive and other work contemplated under this EECPRP. The integrity and safety of on-site and off-site structures will be maintained during all invasive, excavation or other remedial activity performed under the EECPRP.

5.7.4 Dewatering

Dewatering is anticipated to excavate soil and fill material below the water table (expected between 8 and 10 feet below sidewalk grade [elevation 1 to 2 feet NAVD88]), particularly during excavation for elevator pits and the deep foundation at the east end of the Site. Dewatering for this site will use a pumping system, settling tanks, and a treatment system prior to discharge into the NYC combined sewer system. All required permits will be obtained from the NYCDEP before discharging groundwater into the combined sewer system.

5.7.5 Equipment and Material Staging

Equipment and materials will be stored and staged in a manner that complies with applicable laws and regulations.

5.7.6 Stabilized Construction Entrance

Steps will be taken to ensure that trucks departing the Site will not track soil, fill or debris off-site. Such actions may include use of cleaned asphalt or concrete pads, or use of stone or other aggregate-based egress paths between the truck inspection station and the Site exit. Measures will be taken to ensure that adjacent roadways are kept clean of project-related soils, fill and debris.

5.7.7 Truck Inspection Station

An outbound-truck inspection station will be established close to the Site exit. Before exiting the Site, trucks will be required to stop at the truck inspection station and will be examined for evidence of contaminated soil on the undercarriage, body, and wheels. Brooms, shovels and clean water will be used to remove soil and debris from vehicles and equipment, as necessary.

5.7.8 Extreme Storm Preparedness and Response Contingency Plan

Damage from flooding or storm surge can include dislocation of soil and stockpiled materials, dislocation of Site structures and construction materials and equipment, and dislocation of support of excavation assemblies. Damage from wind during an extreme storm event can create unsafe or unstable structures, damage safety structures and cause downed power lines creating dangerous Site conditions and loss of power. In the event of emergency conditions caused by an extreme storm event, the enrollee will undertake the following steps for site preparedness prior to the event and response after the event.

Storm Preparedness

Preparations in advance of an extreme storm event will include the following:

- containerized hazardous materials and fuels will be removed from the property
- loose materials will be secured to prevent dislocation and blowing by wind or water
- heavy equipment such as excavators and generators will be removed from excavated areas, trenches and depressions on the property to high ground or removed from the property
- an inventory of the property with photographs will be performed to establish conditions for the Site and equipment prior to the event
- stockpile covers for soil and fill will be secured by adding weights such as sandbags for added security and worn or ripped stockpile covers will be replaced with competent covers
- stockpiled hazardous wastes will be removed from the property
- stormwater management systems will be inspected and fortified, including, as necessary: (1) clean and reposition silt fences, hay bales; (2) clean storm sewer filters and traps; and (3) secure and protect pumps and hosing.

Storm Response

At the conclusion of an extreme storm event, as soon as it is safe to access the property, a complete inspection will be performed and a Site inspection report will be submitted to the NYSDEC and OER. Damage from storm conditions that result in acute public safety threats, such as downed power lines or imminent collapse of buildings, structures or equipment will be reported to public safety authorities via appropriate means such as calling 911. Petroleum spills will be reported to NYSDEC within 2 hours of identification and consistent with State regulations. Emergency and spill conditions will also be reported to the OER. Public safety structures, such as construction security fences will be repaired promptly to eliminate public safety threats. Debris will be collected and removed. Dewatering will be performed in compliance with existing laws and regulations and consistent with emergency notifications, if any, from proper authorities. Eroded areas of soil including unsafe slopes will be stabilized and fortified. Dislocated materials will be collected and appropriately managed. Support of excavation structure will be inspected and fortified as necessary. Impacted stockpiles will be contained and damaged stockpile covers will be replaced. Stormwater control systems and structures will be inspected and maintained as necessary. If soil or fill materials are discharged off Site to adjacent properties, property owners, the NYSDEC, and the OER will be notified.

A corrective measures plan, designed to remove and clean dislocated material, will be submitted to the NYSDEC and OER and implemented following approval by the NYSDEC and access by the property owner. Impacted off-site areas may require characterization based on site conditions, at the discretion of the NYSDEC. If onsite petroleum spills are identified, a qualified environmental professional will determine the nature and extent of the spill and report to the NYSDEC Spill Hotline at DEC 800-457-7362 within statutory defined timelines. If the source of the spill is ongoing and can be identified, it should be stopped if this can be done safely. Potential hazards will be addressed immediately, consistent with guidance issued by NYSDEC.

Storm Response Reporting

A Site inspection report will be submitted to the NYSDEC and OER at the completion of Site inspection. An inspection report established by the OER is available on OER's website (www.nyc.gov/oer) and will be used for this purpose. Site conditions will be compared to the inventory of site conditions and material performed before the storm event and significant differences will be noted. The site inspection report will be sent to the NYSDEC and OER project managers and will include the site name, address, tax block and lot, site primary and alternate contact name and phone number. Damage and soil release assessment will include:

- whether the project had stockpiles and their post-storm condition;
    - If stockpiles are found to be damaged, the damage will be photodocumented and plan for repair developed.
- whether soil from the site was dislocated and whether any of the soil left the site;
    - If soil is found to have left the Site, it will be photodocumented and the volume and nature of impact will be estimated.
- description of erosion damage;
- description of equipment damage;
- description of damage to the remedial program or the construction program, such as damage to the support of excavation;
- whether storm conditions resulted in a change to exposure pathways;
- presence of petroleum or other spills and status of spill reporting to NYSDEC; and
- description of and schedule for corrective actions.

This report should be completed and submitted to the NYSDEC and OER project managers within 24 hours after safe entry to the Site.

5.8 Traffic Control

Drivers of trucks leaving the Site with soil/fill will be instructed to proceed without stopping in the vicinity of the Site to prevent neighborhood impacts. The planned route on local roads for trucks leaving the site is shown on Figure 8.

5.9 Demobilization

Demobilization will include:

- As necessary, restoration of temporary access areas and areas that may have been disturbed to accommodate support areas (e.g., staging areas, decontamination areas, storage areas, temporary water management areas, and access area);
- Removal of sediment from erosion control measures and truck wash and disposal of materials in accordance with applicable laws and regulations;
- Equipment decontamination; and
- General refuse disposal.

Equipment will be decontaminated and demobilized at the completion of all field activities. Large construction equipment (e.g., excavators) will be washed at the truck inspection station as necessary. In addition, all contaminated construction-derived waste will be appropriately disposed of.

5.10 Reporting and Record Keeping

Daily Reports

Daily reports, providing a general summary of activities for each day of active construction work, pertaining to excavation and the engineering controls, will be emailed to the NYSDEC Project Manager by the end of the following business day. Those reports will include:

- Project number, statement of the activities, an update of progress made, locations of excavation, and other remedial-related work performed;
- Quantities of material imported and exported from the Site;
- Status of on-site soil/fill stockpiles;
- A summary of citizen complaints, with relevant details (basis of complaint, actions taken, etc.);

- A summary of CAMP results, noting if and the reason for action levels being triggered; and
- Photograph of notable Site conditions and activities.

The frequency of the reporting period may be revised in consultation with the NYSDEC project manager based on planned project tasks. Daily email reports are not intended to be the primary mode of communication for notification to the NYSDEC and OER of emergencies (accidents, spills), requests for changes to the EECPRP or other sensitive or time critical information. However, such information will be included in the daily reports. Emergency conditions and changes to the EECPRP will be communicated directly to the NYSDEC and OER project managers by personal communication. Daily reports will be included as an Appendix in the Remedial Action Report.

Record Keeping and Photo Documentation

Jobsite records will be maintained for remediation-related construction work. These records will be kept on Site during the project and will be available for inspection by NYSDEC and OER staff. Representative photographs will be taken of the Site before construction activities and during major remedial activities to illustrate remedial program elements and contaminant source areas. Photographs will be submitted at the completion of the project in the RAR in digital format.

5.11 Complaint Management

Citizen complaints will be promptly reported to the NYSDEC and OER. Complaints will be addressed and the outcomes reported to the NYSDEC and OER in daily reports. Notices to the NYSDEC and OER will include the nature of the complaint, the party providing the complaint, and the actions taken to resolve any problems.

5.12 Deviations from The EECPRP

Proposed changes to the EECPRP will be reported to, and approved by, the OER Project Manager and will be documented in daily reports and reported in the Remedial Action Report. The process to be followed if there are any deviations from the EECPRP will include a request for approval from the NYSDEC noting the following:

- Reasons for deviating from the approved EECPRP;
- Effect of the deviations on the overall remedy; and

- Determination, with basis, that the remedy with the deviation(s) is protective of public health and the environment.

6.0 REMEDIAL ACTION REPORT

A Remedial Action Report (RAR) will be submitted to the NYSDEC and OER following implementation of the engineering controls defined in this EECPRP. The RAR will document that the engineering controls required under this EECPRP for vapor mitigation has been completed and has been performed in compliance with this plan. The RAR will include:

- Information required by this EECPRP;
- Text description with thorough detail of all engineering and institutional controls;
- As-built drawings for all constructed engineering controls;
- Manifests for soil or fill disposal;
- Photographic documentation for installation of the required engineering controls;
- Revised Site Management Plan (submitted to and approved by the NYSDEC);
- Description of any deviations from the elements provided in this EECPRP and associated design documents;
- Account of the source area locations and characteristics of all soil or fill material removed from the Site including a map showing the location of these excavated hotspots, tanks or other contaminant source areas;
- Full accounting of the disposal destination of all contaminated material removed from the Site. Documentation associated with disposal of all material will include transportation and disposal records, and letters approving receipt of the material;
- Account of the origin and required chemical quality testing for material imported onto the Site;
- Continue registration of the property with an E-Designation (E-142) by the NYC Department of Buildings;
- Reports and supporting material will be submitted in digital form and final PDF's will include bookmarks for each appendix.

7.0 REMEDIAL ACTION REPORT CERTIFICATION

The RAR will include the following certification:

I, Satyajit Vaidya, am currently a registered professional engineer licensed by the State of New York. I performed professional engineering services and had primary direct responsibility for implementation of the remedial program for the 76 Eleventh Avenue site, site number 13EH-N304M. I certify to the following:

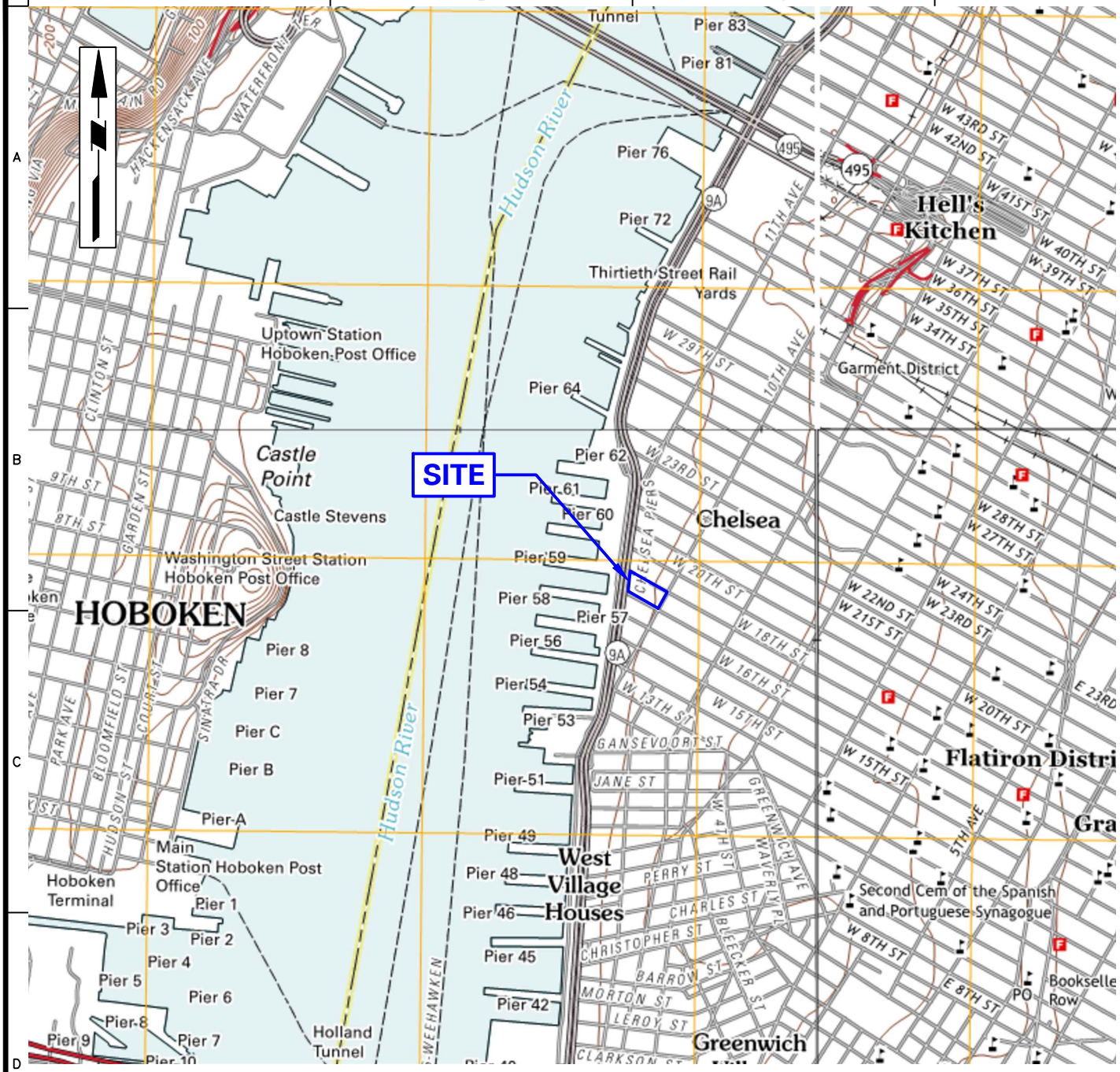
- I have reviewed this document, to which my signature and seal are affixed.
- Engineering Controls implemented during this remedial action were designed by me or a person under my direct supervision and achieve the goals established in the EECPRP for this Site.
- The Engineering Controls constructed during this remedial action were professionally observed by me or by a person under my direct supervision and (1) are consistent with the Engineering Control design established in the EECPRP and (2) are accurately reflected in the text and drawings for as-built design reported in this Remedial Action Report.
- The NYSDEC-approved Excavation and Engineering Controls Protection and Restoration Plan dated February 11, 2016 was implemented and that all requirements in those documents have been substantively complied with. I certify that contaminated soil, fill, liquids or other material from the property were taken to facilities licensed to accept this material in full compliance with applicable laws and regulations.

8.0 SCHEDULE

The table below presents a schedule for the proposed remedial action and reporting. If the schedule for remediation and development activities changes, it will be updated and submitted to the OER. Currently, construction is anticipated to start on or about April 2016.

Schedule Milestone	Weeks from Construction Start	Duration (weeks)
NYSDEC Approval of EECPRP	0	6
Mobilization	2	2
Foundation Excavation	38	36
Demobilization	110	72
Submit Remedial Action Report	115	5

FIGURES



NOTE: BASE MAP IS TAKEN FROM USGS 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE CENTRAL PARK, BROOKLYN, JERSEY CITY, AND WEEKHAWKEN QUADRANGLES.

LEGEND:

APPROXIMATE SITE BOUNDARY

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21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
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Langan Engineering and Environmental Services, Inc.
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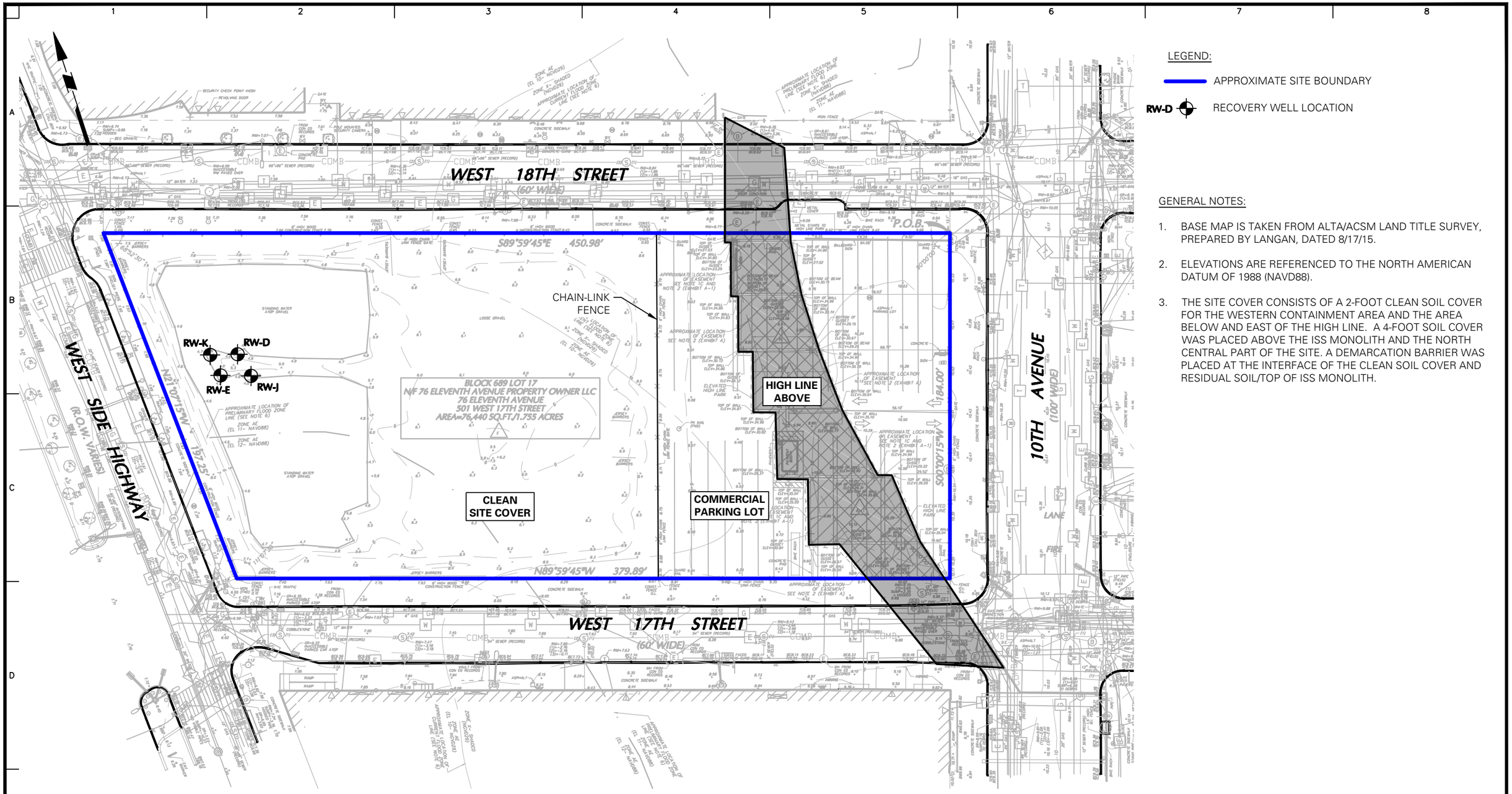
Project	76 ELEVENTH AVENUE BLOCK No. 689, LOT No. 17 NEW YORK NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	100513101
Figure No.	1
Date	3/10/2016
Scale	N.T.S.
Drawn By	AT
Checked By	GN
Submission Date	MARCH 2016
Sheet	1 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 1 - Site Location Map.dwg Date: 3/10/2016 Time: 11:38 User: atashji Style Table: Langan.stb Layout: SLM



LEGEND:

- APPROXIMATE SITE BOUNDARY
- RW-D RECOVERY WELL LOCATION

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM ALTA/ACSM LAND TITLE SURVEY, PREPARED BY LANGAN, DATED 8/17/15.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1988 (NAVD88).
3. THE SITE COVER CONSISTS OF A 2-FOOT CLEAN SOIL COVER FOR THE WESTERN CONTAINMENT AREA AND THE AREA BELOW AND EAST OF THE HIGH LINE. A 4-FOOT SOIL COVER WAS PLACED ABOVE THE ISS MONOLITH AND THE NORTH CENTRAL PART OF THE SITE. A DEMARCATION BARRIER WAS PLACED AT THE INTERFACE OF THE CLEAN SOIL COVER AND RESIDUAL SOIL/TOP OF ISS MONOLITH.

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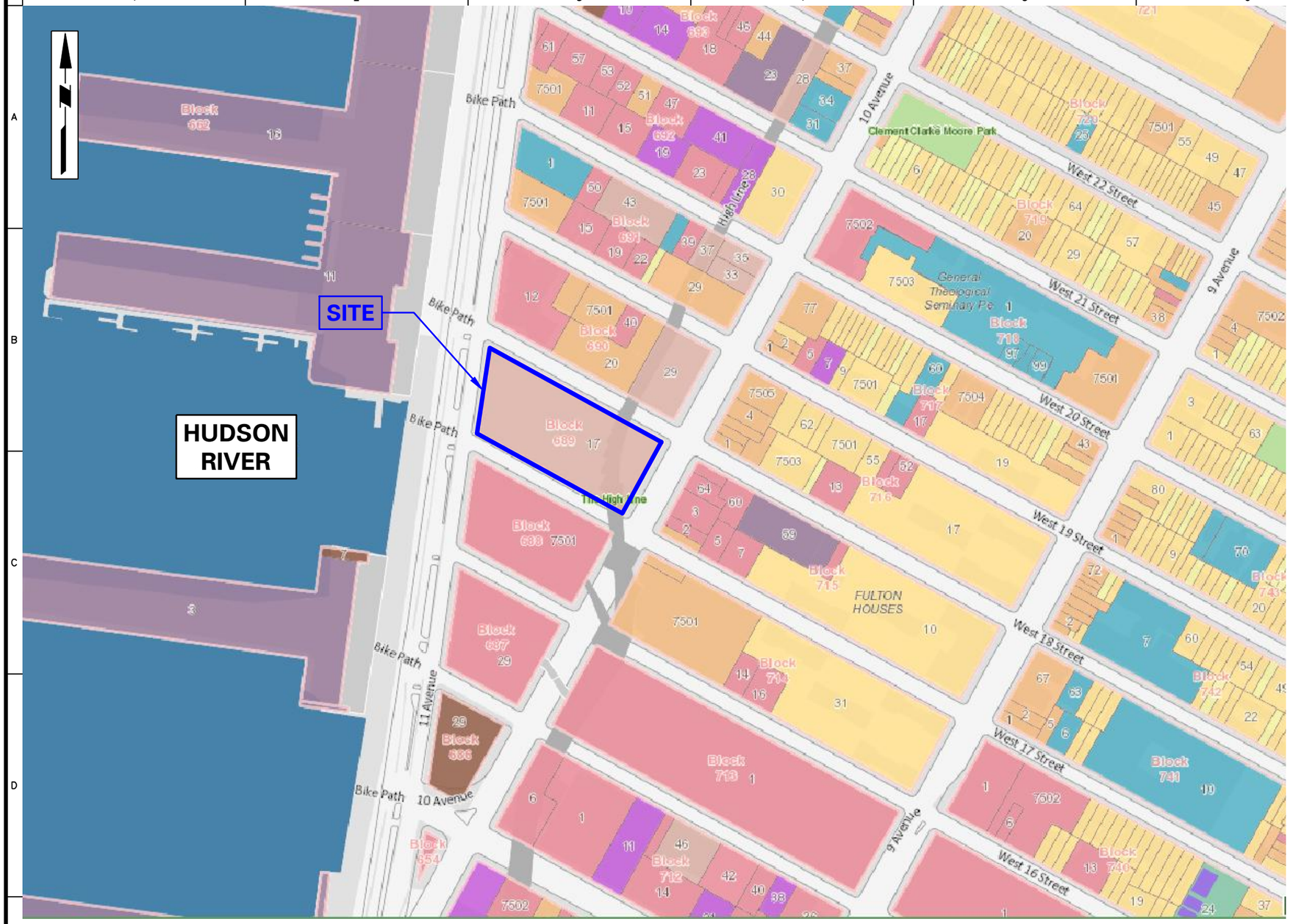
Project	76 ELEVENTH AVENUE BLOCK No. 689, LOT No. 17 NEW YORK NEW YORK
Figure Title	SITE PLAN (EXISTING CONDITIONS)
Project No.	100513101
Date	3/10/2016
Scale	1"=50'
Drawn By / Checked By	AT / GN
Submission Date	MARCH 2016
Figure No.	2
Sheet	2 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 2 - Site Plan.dwg Date: 3/10/2016 Time: 11:35 User: atashji Style Table: Langan.stb Layout: Site Map



LEGEND:

- APPROXIMATE SITE BOUNDARY
- 1 & 2 FAMILY RESIDENTIAL
- MULTI-FAMILY RESIDENTIAL
- MIXED USE
- OPEN SPACE & OUTDOOR RECREATION
- COMMERCIAL
- INSTITUTIONS
- INDUSTRIAL
- PARKING
- TRNASPORTATION/UTILITIES
- VACANT LOTS

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM OASIS NYC MAPS (http://www.oasisnyc.net/map.aspx)

250 0 125 250

SCALE IN FEET

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76 ELEVENTH AVENUE

BLOCK No. 689, LOT No. 17

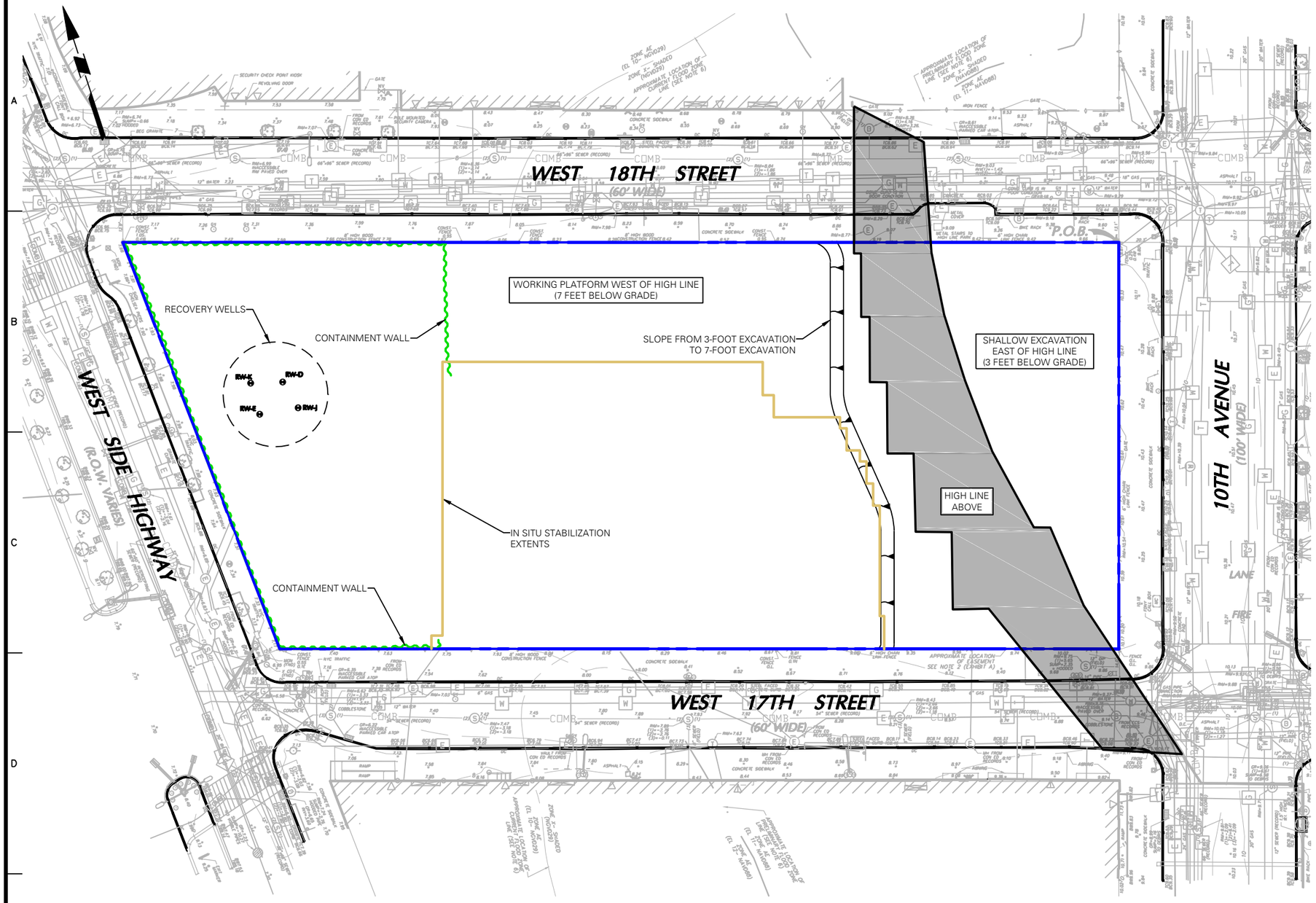
NEW YORK NEW YORK

Figure Title

SURROUNDING LAND USAGE MAP

Project No. 100513101	Figure No. 3
Date 3/10/2016	
Scale 1"=250'	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 3 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 3 - Surrounding Land Use Map.dwg Date: 3/10/2016 Time: 11:37 User: atashji Style Table: Langan.stb Layout: SLUM



LEGEND:

- APPROXIMATE SITE BOUNDARY
- CONTAINMENT WALL
- IN SITU STABILIZATION LIMITS
- RW-E ACTIVE RECOVERY WELL

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM ALTA/ACSM LAND TITLE SURVEY, PREPARED BY LANGAN, DATED 8/17/15.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1988 (NAVD88).
3. LOCATIONS OF EXCAVATION LIMITS AND ENVIRONMENTAL CONTROLS ARE ADAPTED FROM FIGURE 6 OF THE FINAL ENGINEERING REPORT, DECEMBER 11, 2014.

50 0 25 50
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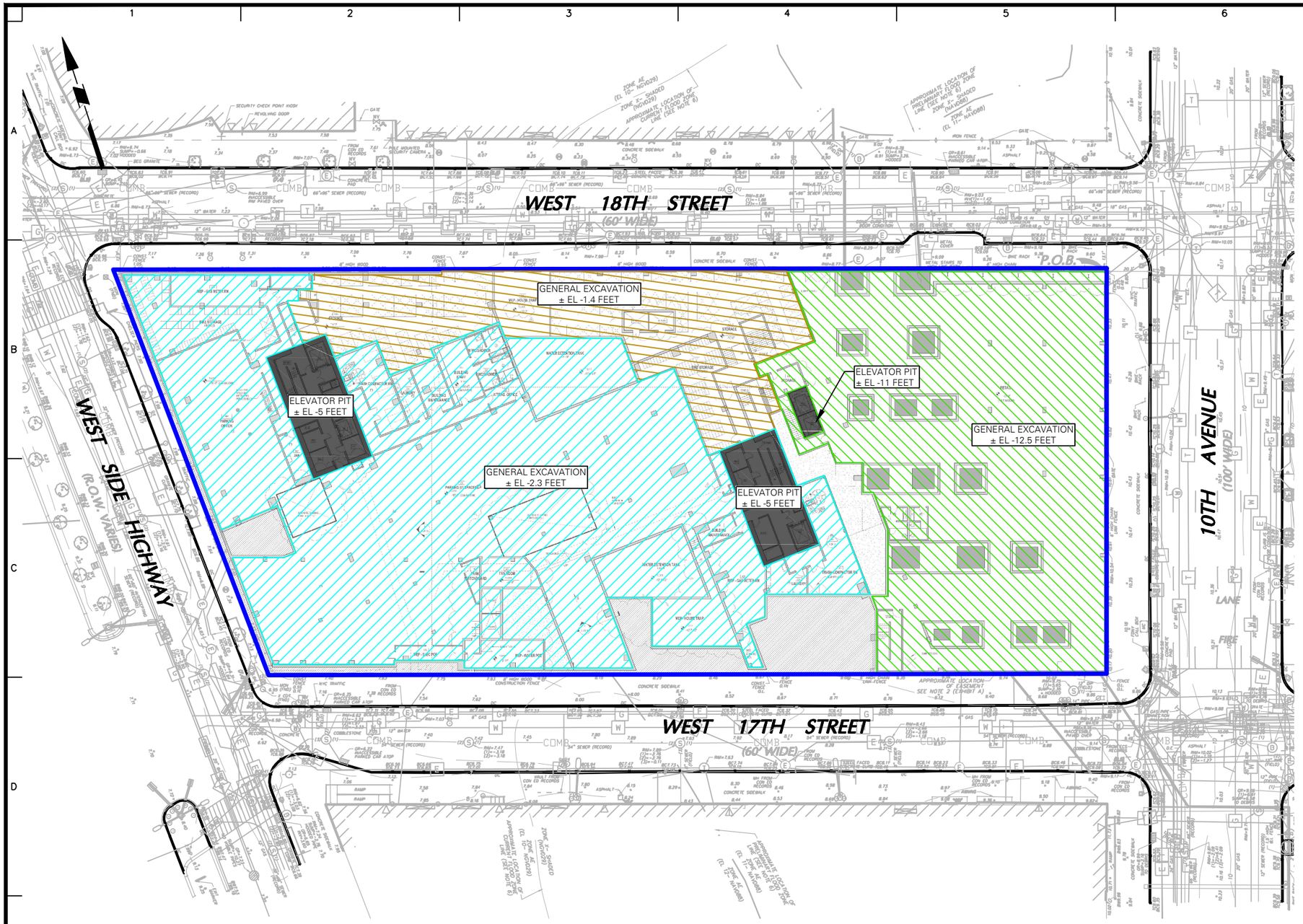
76 ELEVENTH AVENUE
BLOCK No. 689, LOT No. 17
NEW YORK NEW YORK

Figure Title
COMPLETED REMEDIATION AND ENGINEERING CONTROLS MAP

Project No. 100513101	Figure No. 4
Date 3/10/2016	
Scale 1"=50'	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 4 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 4 - Completed Remediation and Engineering Controls Map.dwg Date: 3/10/2016 Time: 11:40 User: atashji Style Table: Langan.stb Layout: Site Map



LEGEND:

- APPROXIMATE SITE BOUNDARY
- WEST EXCAVATION (± ELEVATION 2.3 FEET)
- WEST EXCAVATION (± ELEVATION -1.4 FEET)
- EAST EXCAVATION (± ELEVATION -12.5 FEET)
- SLAB ON GRADE CONSTRUCTION
- ELEVATOR PITS

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM THE FOLLOWING:
   - ALTA/ACSM LAND TITLE SURVEY, PREPARED BY LANGAN, DATED 8/17/15.
   - CELLAR PLAN, PROVIDED BY BIG , DATED 2/12/2016.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1988 (NAVD88).
3. EXTENTS OF EXCAVATIONS AND DEPTH OF EXCAVATIONS ARE ESTIMATED FROM AVAILABLE PROJECT PLANS. INFORMATION PRESENTED IN THIS DRAWING IS FOR REFERENCE ONLY AND NOT FOR CONSTRUCTION.

50 0 25 50
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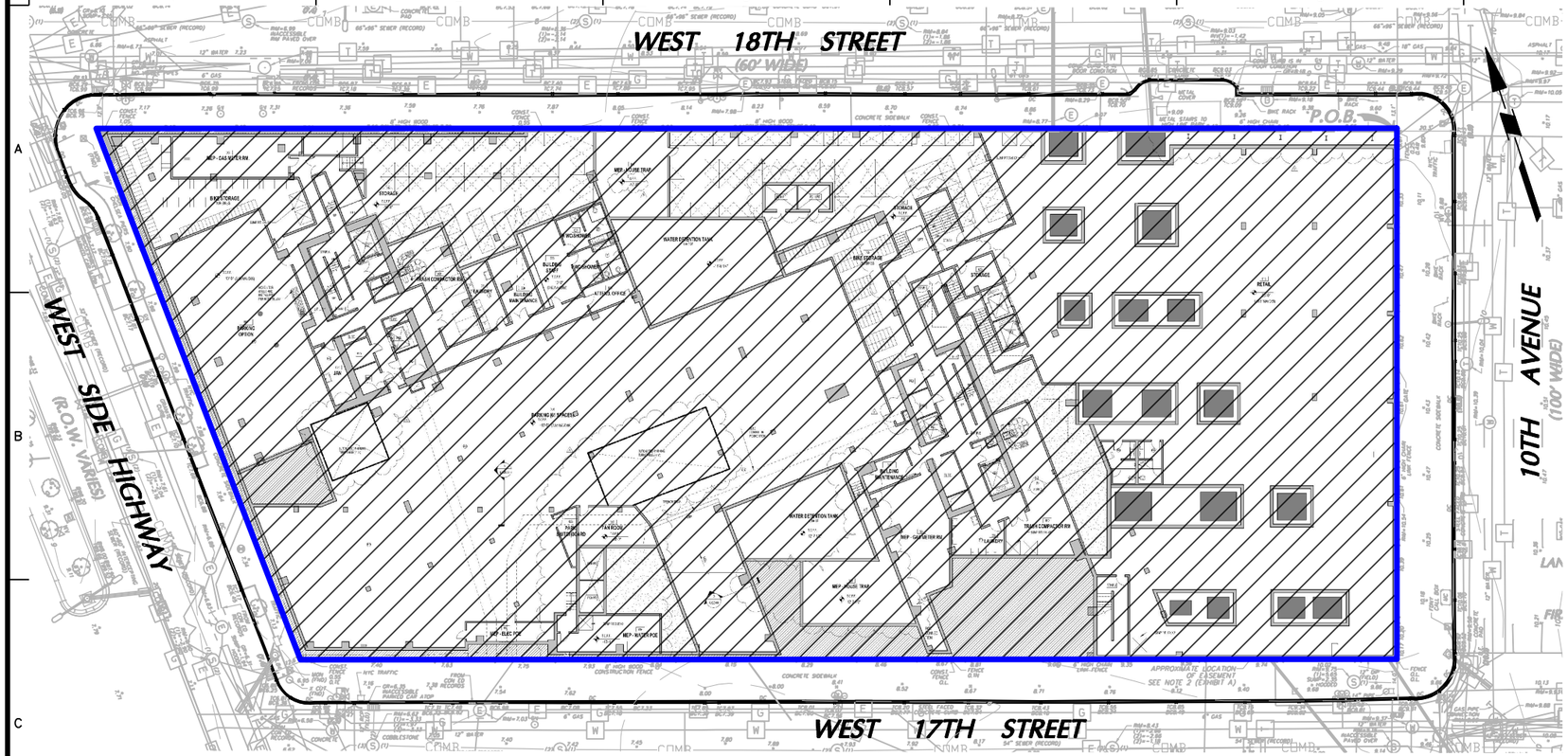
76 ELEVENTH AVENUE
BLOCK No. 689, LOT No. 17
NEW YORK NEW YORK

Figure Title
SITE EXCAVATION PLAN

Project No. 100513101	Figure No. 5
Date 3/10/2016	
Scale 1"=50'	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 5 of 8



PLAN VIEW LEGEND:

APPROXIMATE SITE BOUNDARY

CONCRETE FOUNDATION SLAB WITH WATERPROOFING/VAPOR BARRIER MEMBRANE SYSTEM

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM THE FOLLOWING:
   - ALTA/ACSM LAND TITLE SURVEY, PREPARED BY LANGAN, DATED 8/17/15.
   - CELLAR PLAN, PROVIDED BY BIG, DATED 2/12/16.
2. ELEVATIONS ARE REFERENCED TO THE NORTH AMERICAN DATUM OF 1988 (NAVD88).

50 0 25 50

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76 ELEVENTH AVENUE

BLOCK No. 689, LOT No. 17

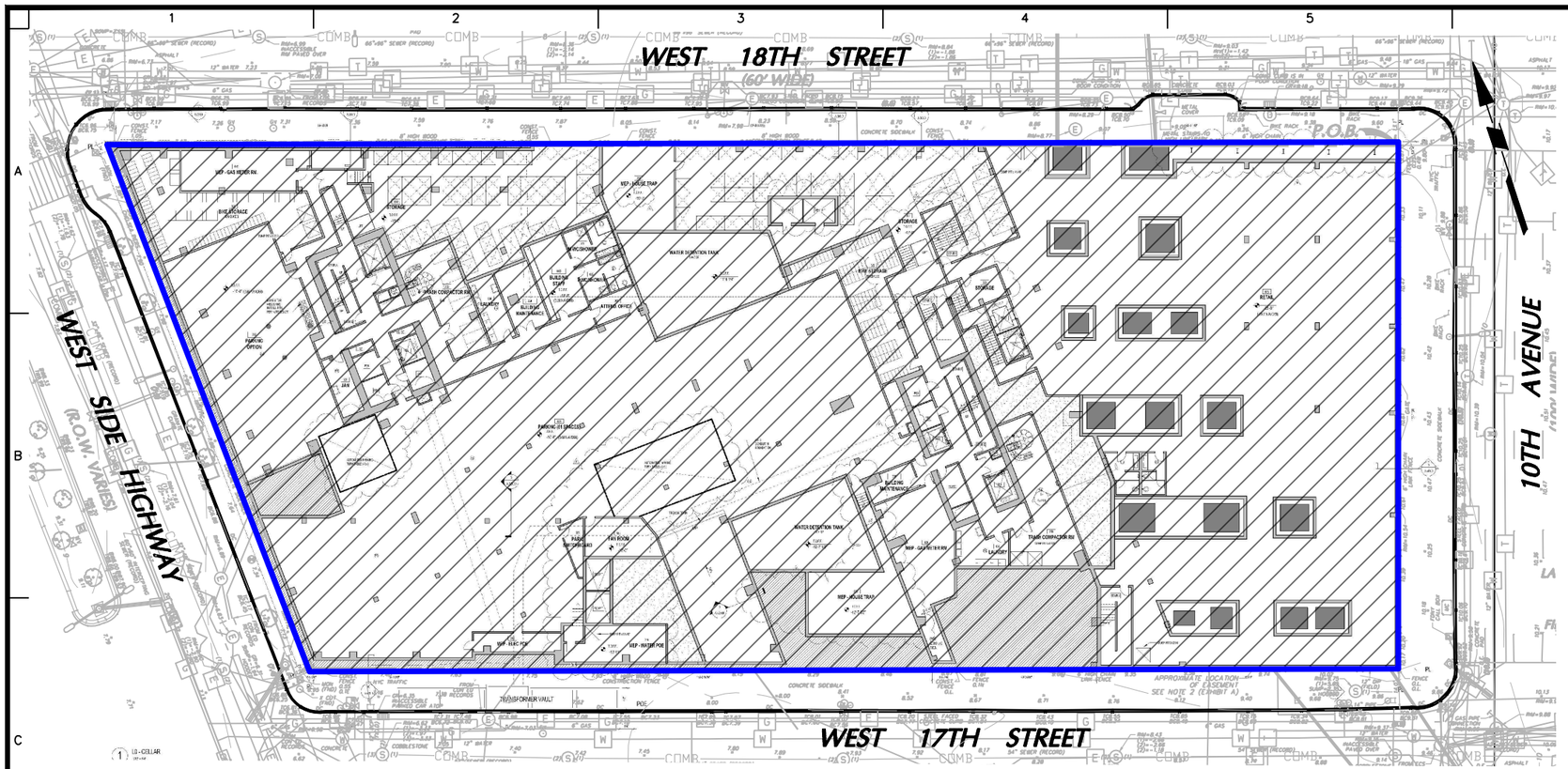
NEW YORK **NEW YORK**

Figure Title

REMEDIAL COVER SYSTEM

Project No. 100513101	Figure No. 6
Date 3/10/2016	
Scale 1"=50'	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 6 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 6 - Remedial Cover System.dwg Date: 3/10/2016 Time: 12:27 User: atashji Style Table: Langan.stb Layout: Remedial Cover System



PLAN VIEW
SCALE: 1"=50'

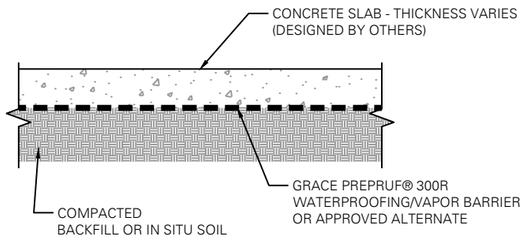
LEGEND:

APPROXIMATE SITE BOUNDARY

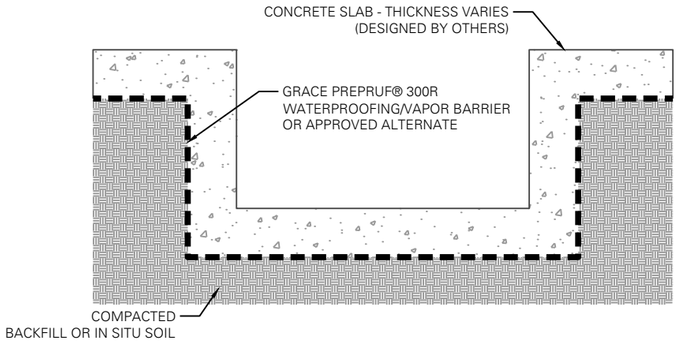
EXTENT OF CONTINUOUS WATERPROOFING/VAPOR BARRIER SYSTEM

GENERAL NOTES:

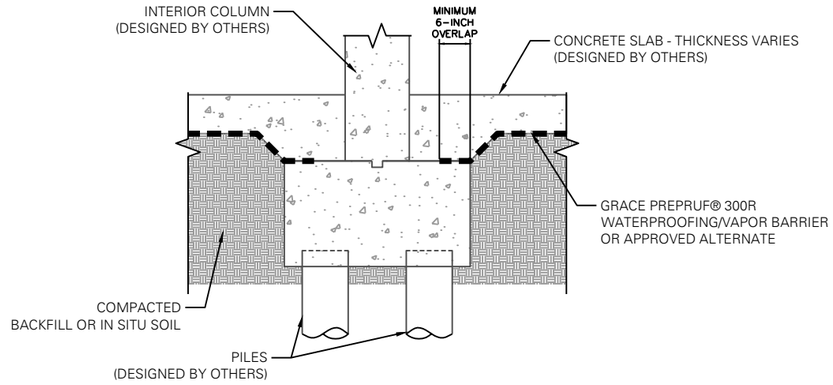
1. BASE MAP IS TAKEN FROM THE FOLLOWING:
   - ALTA/ACSM LAND TITLE SURVEY, PREPARED BY LANGAN, DATED 8/17/15.
   - CELLAR PLAN, PROVIDED BIG, DATED 2/12/16.
3. REFER TO DETAILS 1, 2, AND 3 FOR TYPICAL INSTALLATION.
4. WATERPROOFING/VAPOR BARRIER MEMBRANE SHALL BE INSTALLED AS A CONTINUOUS MEMBRANE IN ACCORDANCE WITH MANUFACTURE'S SPECIFICATIONS. THE CONTRACTOR SHALL PROVIDED AN AS-BUILT DRAWING AFTER INSTALLATION.



DETAIL 1: TYPICAL WATERPROOFING/VAPOR BARRIER INSTALLATION BENEATH CONCRETE SLAB
(NOT TO SCALE)



DETAIL 2: TYPICAL WATERPROOFING/VAPOR BARRIER INSTALLATION ELEVATOR/SUMP PIT
(NOT TO SCALE)



DETAIL 3: TYPICAL WATERPROOFING/VAPOR BARRIER INSTALLATION AT PILE CAP
(NOT TO SCALE)

50 0 25 50
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BLOCK No. 689, LOT No. 17
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Figure Title
WATERPROOFING/ VAPOR BARRIER EXTENT AND DETAILS

Project No. 100513101	Figure No. 7
Date 3/10/2016	
Scale AS NOTED	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 7 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 7 - Waterproofing-Vapor Barrier Extent and Details.dwg Date: 3/10/2016 Time: 12:02 User: atashji Style Table: Langan.stb Layout: Site Map

LEGEND:

- APPROXIMATE SITE BOUNDARY
- TRUCK ROUTE

- **Local Truck Route**
- **Limited Local Truck Route**
  Some of the roadways in Staten Island are designated as Limited Local Truck Routes. These roadways serve as Local Truck Routes but are limited to trucks with two axles and six tires.
- **Through Truck Route**
- **Through Truck Route on Expressway**
- **Industrial Business Zones (IBZ)**
- **Parks and Open Spaces**
- **29A Highway Exit**
- **Commercial Vehicles Prohibited**

GENERAL NOTES:

1. BASE MAP IS TAKEN FROM NEW YORK CITY DEPARTMENT OF TRANSPORTATION COMMERCIAL TRUCK ROUTE MAP FOR 2015.

1,500 0 750 1,500
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BLOCK No. 689, LOT No. 17
NEW YORK NEW YORK

Figure Title
TRUCK ROUTE MAP

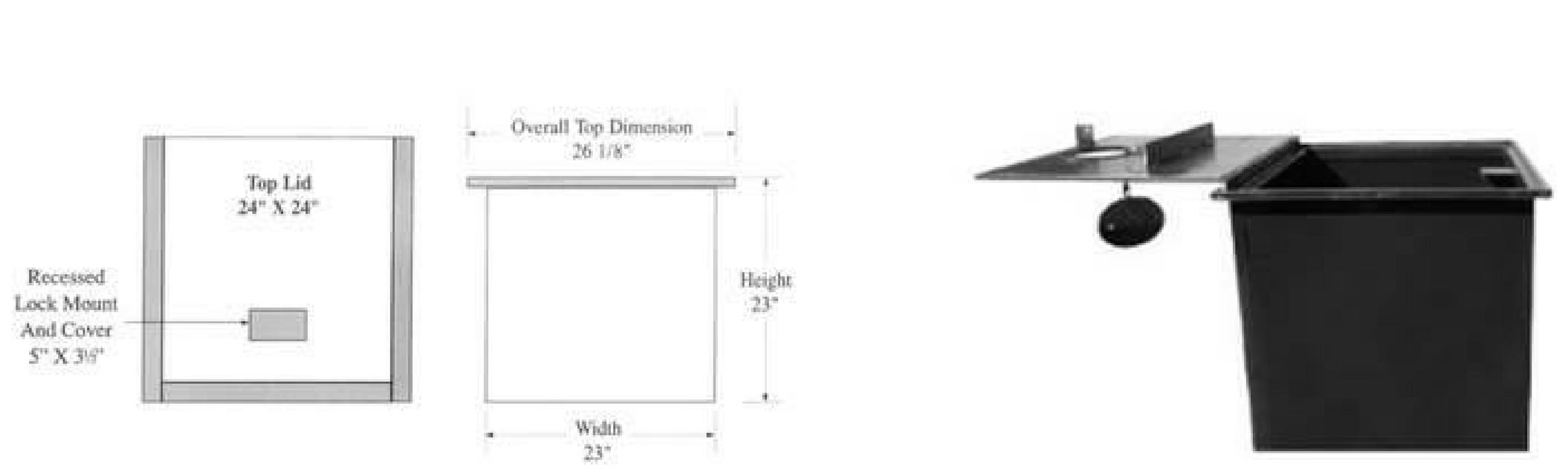
Project No. 100513101	Figure No. 8
Date 3/10/2016	
Scale 1"=1,500'	
Drawn By AT / Checked By GN	
Submission Date MARCH 2016	Sheet 8 of 8

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\OER RAWP\Figure 8 - Truck Route Map.dwg Date: 3/10/2016 Time: 12:19 User: atashji Style Table: Langan.stb Layout: Truck Route Map

APPENDIX A

Proposed Development Plans

1 L0 - CELLAR
3/32" = 1'-0"



1. The stainless steel casing shall be completed no more than six (6) inches below the top of cellar slab and be completed within flush-mount road boxes; wells need to be sealed approximately 1-foot below bottom of vault.
2. The final well covers shall be completed flush with the top of cellar slab and readily accessible. Vaults will be lockable and constructed of steel frame, diamond-plate steel cover (minimum 3/8-inch thick), AASHTO H20 load rating, and lids allow for 180 degree lay back. The vault dimensions will 24 inch by 24 inch by 24 inch. The vault shall be weatherproof with a gasket seal around the lid.
3. Penetrations in the foundation waterproofing for recovery wells are the responsibility of the CONTRACTOR. All penetrations through the foundation waterproofing shall be sealed in accordance with manufacturer specifications and recommendations.

COLD TAR WELL CONSTRUCTION

WOODS BAGOT
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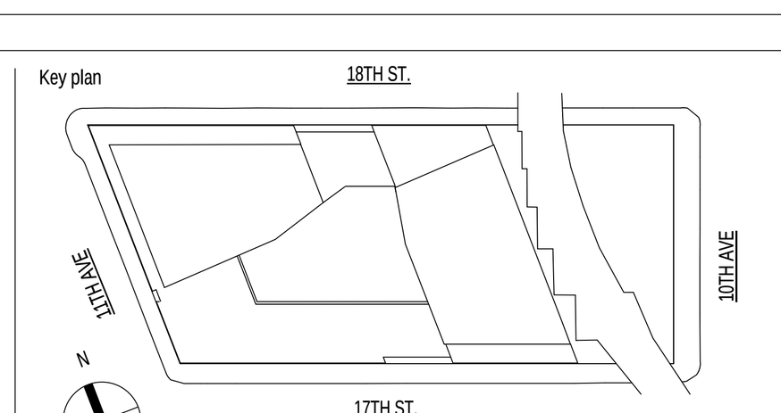
Executive Architect 646.756.3300
WSP Structures, 228 East 45th Street, 3rd Floor, New York, NY 10017 — Structural Engineer 212.687.9888
Cosentini, Two Pennsylvania Plaza, New York, NY 10121 — MEP Engineer 212.615.3600
Philip Habib & Associates, 102 Madison Avenue, New York, NY 10016 — Civil Engineer 212.929.5656
Langan, 619 River Drive Center 1, Elmwood Park, NJ 07407 — Geotechnical Consultant 201.794.6900
GMS, 129 West 27th Street, 5th Floor, New York, NY 10001 — Facade Consultant 212.254.0030
Van Deusen & Associates, 120 Eagle Rock Ave, Suite 310, East Hanover, NJ 07936 — Vertical Transportation 973.994.9220
Development Consulting Services, 330 West 42nd Street, New York, NY 10036 — Zoning 212.714.0280
Gillman Consulting, 40 Worth Street, New York, NY 10013 — Code Consultant / Expeditor 212.349.9304

Key plan



NOT FOR CONSTRUCTION

NOTES & LEGEND
CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK OR PREPARING SHOP DRAWINGS. DO NOT SCALE DRAWING.
THESE DRAWINGS ARE INSTRUMENTS OF SERVICE AND AS SUCH MAY NOT BE USED FOR OTHER PROJECTS, FOR ADDITIONS TO THIS PROJECT OR COMPLETION OF THIS PROJECT BY OTHERS.

Recent revision history

DATE	ISSUE	Revision Number
16/03/11	DESIGN DEVELOPMENT	
16/02/12	EXC AND FOUND BID SET ADDENDUM 1	A
16/01/22	EXTERIOR WALL BID SET	
16/01/15	EXC AND FOUND BID SET	
15/10/20	SCHEMATIC DESIGN	

Stamp

600 Madison Ave New York, NY 10022
212.300.8000

Project
76 ELEVENTH AVE

Client
76 ELEVENTH AVENUE PROPERTY OWNER, LLC

Issuer
BIG
BJARKE INGELS GROUP
61 BROADWAY, SUITE 3300
NEW YORK, NY 10006, USA
T +1 347 549 4141

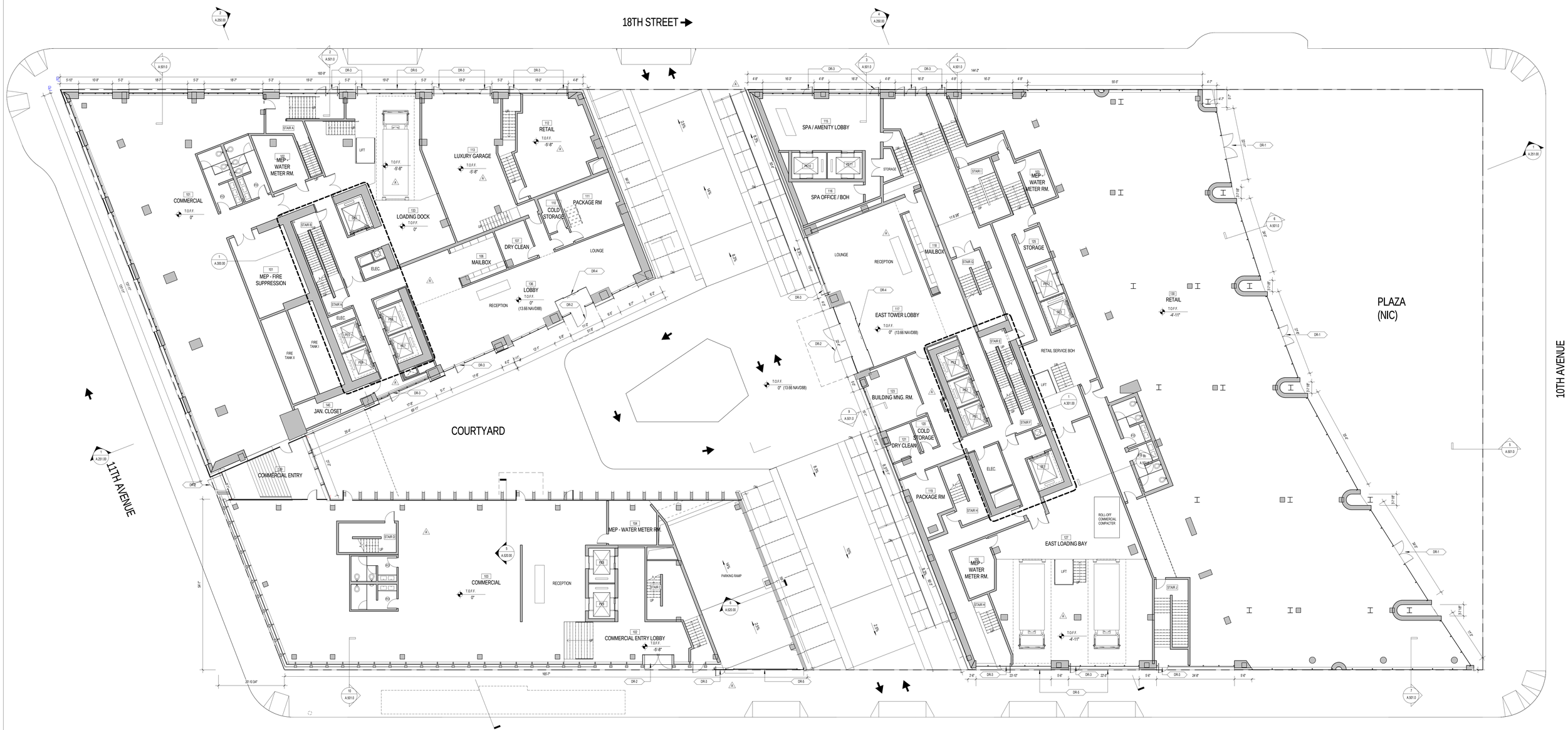
Project number
15508

Checked
--- ---

Sheet size 36" x 48"
Scale 3/32" = 1'-0"

Sheet title
CELLAR

Sheet number
A.101.00



1 FLR 1 GROUND FLOOR
3/32" = 1'-0"

WOODS BAGOT
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New York, NY 10017

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Two Pennsylvania Plaza
New York, NY 10121

Philip Habib & Associates
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New York, NY 10016

Executive Architect
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Structural Engineer
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Civil Engineer
212.925.5656

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Geotechnical Consultant
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Façade Consultant
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Vertical Transportation
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Zoning
212.714.0280

Gillman Consulting
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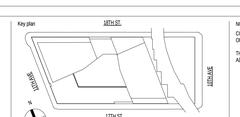
New York, NY 10013

Code Consultant / Expeditor
212.349.8004

Key plan



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NOTES & LEGEND

CONTRACTOR MUST VERIFY ALL DIMENSIONS ON SITE BEFORE COMMENCING WORK OR PREPARING SHOP DRAWINGS. DO NOT SCALE DRAWING.

Recent revision history

DATE	ISSUE	Revision Number
19/03/11	DESIGN DEVELOPMENT	
19/02/12	EXC AND FOUND BID SET ADDENDUM 1	A
19/01/22	EXTERIOR WALL BID SET	
18/01/15	EXC AND FOUND BID SET	
15/10/20	SCHEMATIC DESIGN	

Stamp

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15508

Checked		Sheet size	Scale
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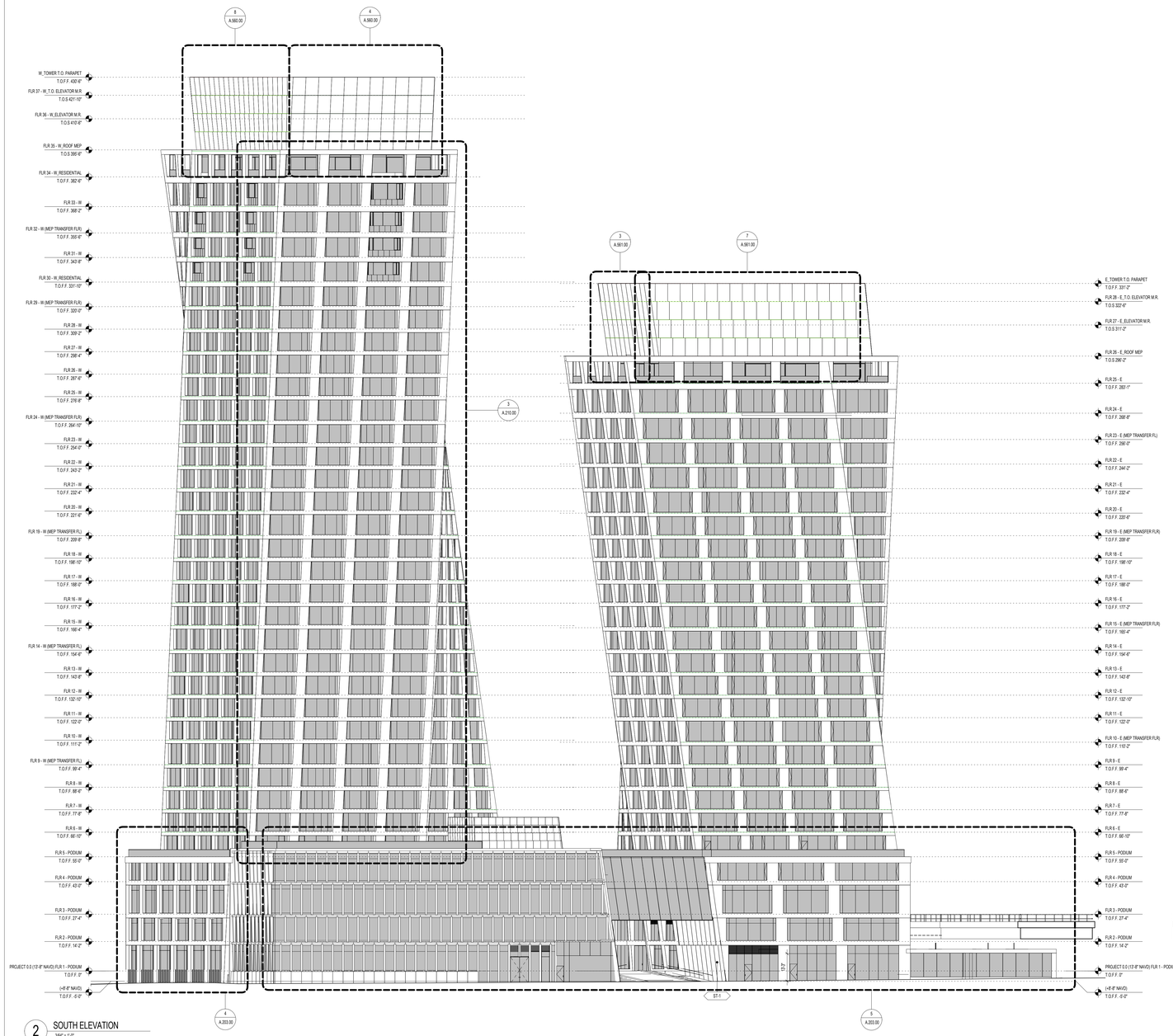
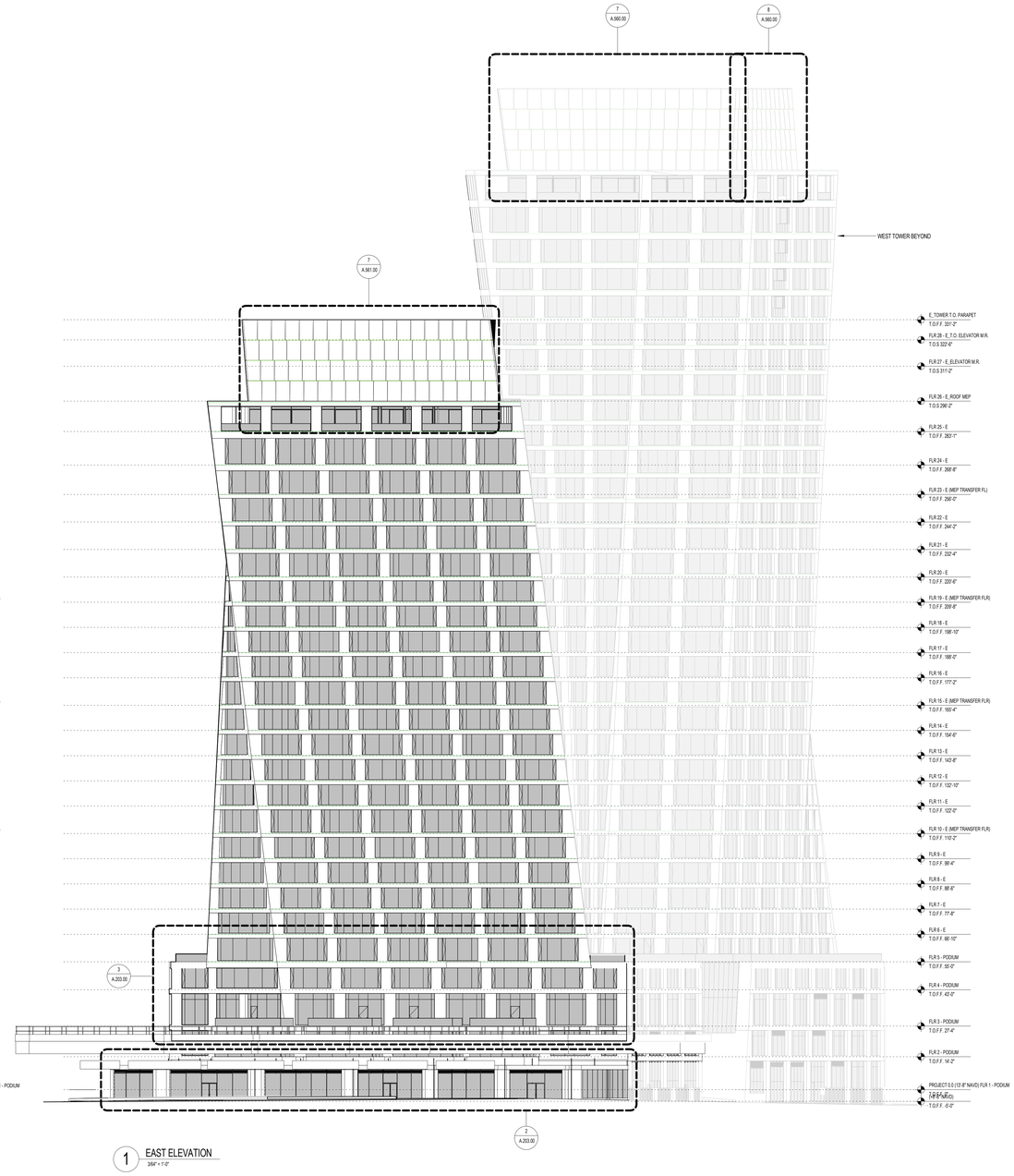
Sheet title
FLR 1 GROUND FLOOR

Sheet number
A.102.00



2 SOUTH ELEVATION
3/64" = 1'-0"



1 EAST ELEVATION
3/64" = 1'-0"

WOODS BAGOT
© Woods Bagot

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Code Consultant / Expeditor
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Key plan

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NOTES & LEGEND

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Recent revision history

DATE	ISSUE	Revision Number
16/03/11	DESIGN DEVELOPMENT	
16/01/22	EXTERIOR WALL MID SET	
15/10/20	SCHEMATIC DESIGN	

Stamp

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Project number
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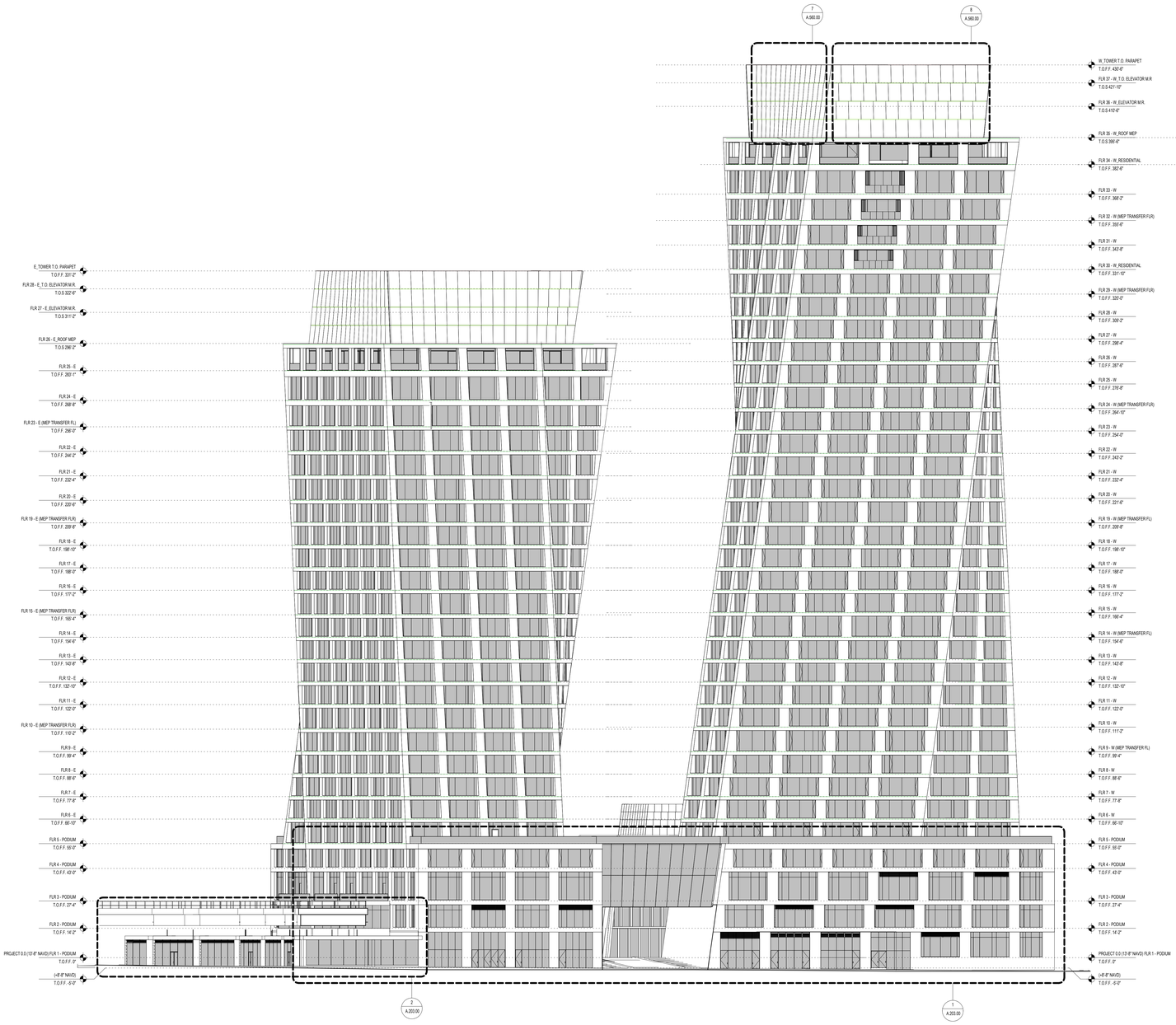
Checked

Sheet size
36" x 48"

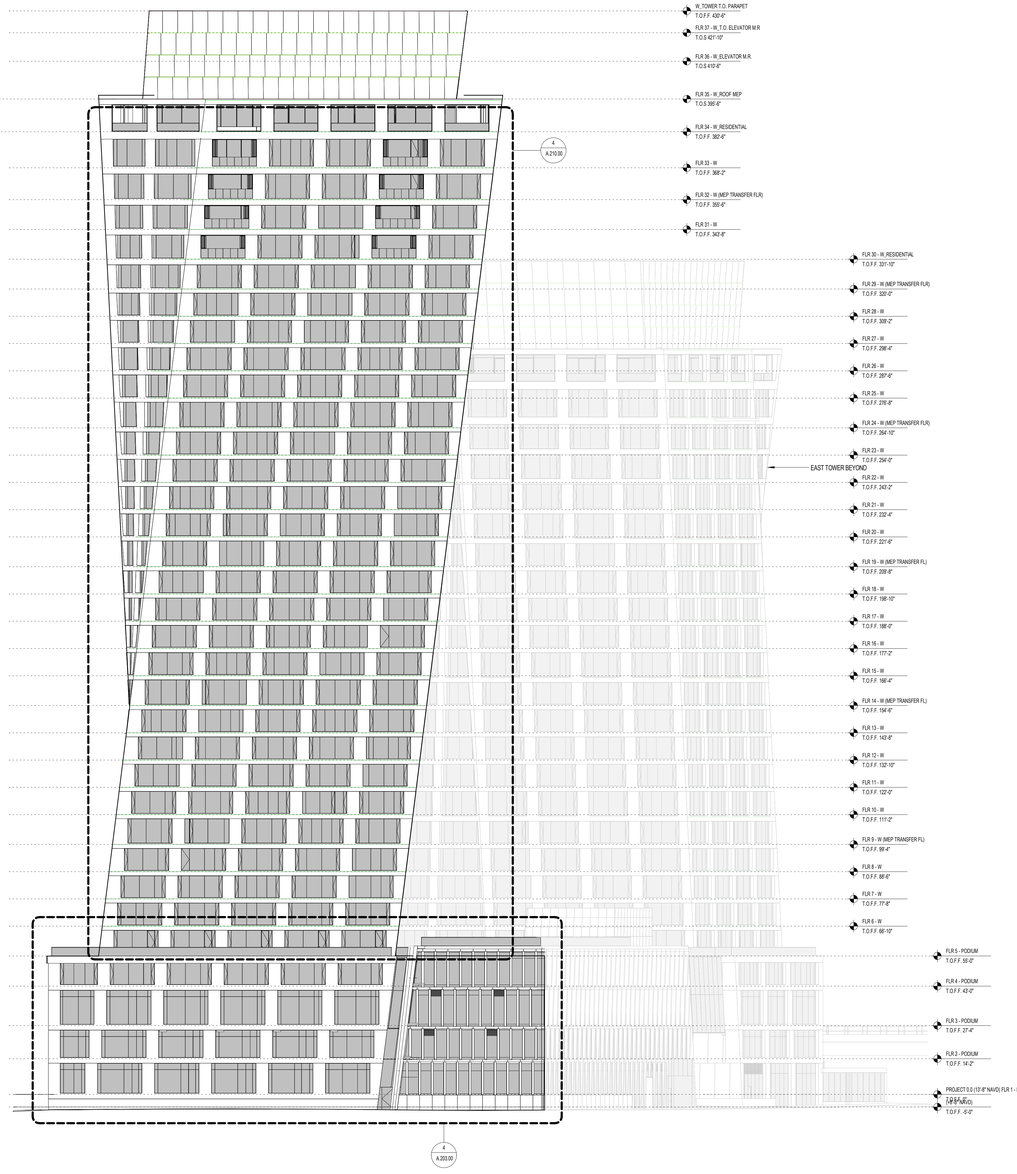
Scale
3/64" = 1'-0"

Sheet title
EAST AND SOUTH ELEVATION

Sheet number
A.200.00



2 NORTH ELEVATION
3/64" = 1'-0"



1 WEST ELEVATION
3/64" = 1'-0"

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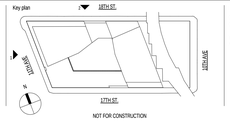

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Sheet title
WEST AND NORTH ELEVATION

Sheet number
A.201.00

APPENDIX B

Soil/Materials Management Plan

SOIL/MATERIALS MANAGEMENT PLAN

1.0 SOIL SCREENING METHODS

Visual, olfactory and photoionization detector (PID) soil-screening and assessment will be performed under the supervision of a Qualified Environmental Professional (QEP) and will be reported in the Remedial Action Report (RAR). Soil will be screened during invasive work performed during construction prior to issuance of final signoff by the New York City Office of Environmental Remediation (OER).

2.0 STOCKPILE METHODS

If reuse of existing clean backfill comprising the Site cap is preferred, in situ soil and solid waste will be excavated and stockpiled separately from the clean backfill and construction materials. Stockpiles will be used only when necessary and will be removed as soon as practicable. While stockpiles are in place, they will be inspected daily, and before and after every storm event. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by the NYSDEC and OER. Excavated soils will be stockpiled on, at minimum, double layers of 8-mil sheeting. Stockpiles will be kept covered at all times with appropriately anchored plastic tarps and will be routinely inspected. Broken or ripped tarps will be promptly replaced.

All stockpile activities will be compliant with applicable laws and regulations. Soil stockpile areas will be appropriately graded to control run-off in accordance with applicable laws and regulations. Stockpiles of excavated soils and other materials shall be located at least of 50 feet from the property boundaries, where possible. Hay bales or equivalent will surround soil stockpiles except for areas where access by equipment is required. Silt fencing and hay bales will be used as needed near catch basins, surface waters and other discharge points.

3.0 CHARACTERIZATION OF EXCAVATED MATERIALS

Soil/fill or other excavated media that is transported off-site for disposal will be sampled in a manner required by the receiving facility, and in compliance with applicable laws and regulations. Clean backfill proposed for reuse on-site will be managed as defined in this plan. In situ soil stabilization (ISS) material consists of a cement-bentonite blend with Site soil used as the aggregate. Therefore, this material shall be handled as a regulated solid waste when excavated.

4.0 MATERIALS EXCAVATION, LOAD-OUT, AND DEPARTURE

The PE/QEP overseeing the remedial action will:

- Oversee construction work related to the engineering controls and the excavation and load-out of Site material;
- Ensure that there is a party responsible for the safe execution of invasive and other work performed under this work plan;
- Ensure that Site development activities and development-related grading cuts will not interfere with, or otherwise impair or compromise the remedial activities proposed in the Excavation and Engineering Controls Protection and Restoration Plan (EECPRP);
- Ensure that all loaded, outbound-trucks are inspected and cleaned, if necessary, before leaving the Site; and
- Ensure that all egress points for truck and equipment transport from the Site will be kept clean of site-derived materials during foundation construction.

Locations where vehicles exit the Site shall be inspected daily for evidence of soil tracking off premises. Cleaning of the adjacent streets will be performed as needed to maintain a clean condition with respect to site-derived materials.

Open and uncontrolled mechanical processing of historical fill and contaminated soil on Site will not be permitted without prior NYSDEC approval.

5.0 OFF-SITE MATERIALS TRANSPORT

Loaded vehicles leaving the Site will comply with all applicable materials transportation requirements (including appropriate covering, manifests, and placards) in accordance with applicable laws and regulations, including use of licensed haulers in accordance with 6 NYCRR Part 364 Waste Transporter Permits. Truck liners will be used for loads containing wet, leachable material. Queuing of trucks will be performed on-site, when possible in order to minimize off-site disturbance and nuisances. Off-site queuing will be minimized.

The preferred outbound truck transport route is provided on Figure 8 of the EECPRP. This route takes into account the following factors:

- limiting transport through residential areas and past sensitive sites;
- using mapped truck routes and adherence to NYC Department of Transportation (DOT) commercial truck routes;

- minimizing off-site queuing of trucks entering the facility;
- limiting total distance to major highways;
- promoting safe access to highways; and
- promoting overall safety during transport.

To the extent possible, all trucks loaded with Site materials will travel from the Site using these truck routes. Trucks will not unnecessarily stop or idle in the neighborhood after leaving the project Site.

6.0 MATERIALS DISPOSAL OFF-SITE

The following documentation will be established and reported for each disposal destination used in this project to document that the disposal of regulated material exported from the Site conforms to applicable laws and regulations:

- A letter to each disposal facility describing the material to be disposed of and requesting written acceptance of the material. This letter will state that material to be disposed of is regulated material generated at an environmental remediation Site in New York City under a governmental remediation program. A summary of all chemical data for the material being transported will be included as an attachment to the letter.

- A letter from each disposal facility stating it is in receipt of the correspondence (1, above) and is approved to accept the material. These documents will be included in the RAR.

The RAR will include an itemized account of the destination of all material removed from the Site during the remedial action. Documentation for disposal of all material will include records and approvals for receipt of the material. This information will be presented in the RAR.

All impacted soil/fill or other waste excavated and removed from the Site will be managed as regulated solid waste and will be disposed of in accordance with applicable laws and regulations. Historic fill and contaminated soils taken off-site will be handled as solid waste and will not be disposed of at a Part 360-16 Registration Facility (also known as a Soil Recycling Facility).

Waste characterization will be performed for off-site disposal in a manner required by the receiving facility and in conformance with its applicable permits. Waste characterization sampling and analytical methods, sampling frequency, analytical results and QA/QC will be

reported in the RAR. A manifest system for exported materials will be employed and the information reported in the RAR. If identified, hazardous wastes derived from on-site will be stored, transported, and disposed of in compliance with applicable laws and regulations.

If disposal of soil/fill from this Site is proposed for unregulated disposal (i.e., clean soil removed for development purposes), including transport to a Part 360-16 Registration Facility, a formal request will be made for approval by the NYSDEC with an associated plan compliant with 6 NYCRR Part 360-16. This request and plan will include the location, volume and a description of the material to be recycled, including verification that the material is not impacted by site uses and that the material complies with receipt requirements for recycling under 6 NYCRR Part 360. This material will be appropriately handled and segregated on-site to prevent mixing with impacted material.

7.0 MATERIALS REUSE ON-SITE

The clean soil cover that was imported during the 2014 remediation meets the lower of 6 NYCRR Part 375 Restricted Use Restricted-Residential and Protection of Groundwater Soil Cleanup Objectives (SCO) is acceptable for reuse. Site soil (below the demarcation barrier) and In Situ Stabilization/Solidification (ISS) material is not permitted to be reused on Site. 'Reuse on Site' refers to excavated on-site material which is relocated within the same property on land containing comparable levels of contaminants and is compliant with applicable laws and regulations. Reused materials will be segregated from other materials to be exported from the Site. Material reuse will follow procedures defined in EECPRP.

Organic matter (wood, roots, stumps, etc.) or other waste derived from clearing and grubbing of the Site will not be buried on Site. Soil or fill excavated from the Site for grading or other purposes will not be reused within a cover soil layer or within landscaping berms.

8.0 DEMARCATION

The deepest extent of excavation will contain the building's concrete slab and foundation elements across the Site footprint. Landscaped areas are not expected for this project. Elevation of the top of residual soil/fill will be measured before placement of the building's foundation. All materials beneath the building foundation will be considered impacted and subject to site management after construction is complete. As appropriate, a map showing the demarcation for the Site and all associated documentation will be presented in the RAR.

This demarcation will constitute the top of the site management horizon. Materials within this horizon require adherence to special conditions during future invasive activities as defined in the Site Management Plan (SMP).

9.0 IMPORT OF BACKFILL SOIL FROM OFF-SITE SOURCES

This Section presents the requirements for imported fill materials to be used below the cover layer and within the clean soil cover layer. All imported soils will meet NYSDEC-approved backfill and cover soil quality objectives for this Site. Imported soils will not exceed the lower of 6 NYCRR Part 375 Restricted Use Restricted-Residential and Protection of Groundwater SCOs.

Sources of backfill and, if required, cover soil to be imported to the Site will be evaluated in accordance with NYSDEC *DER-10 Technical Guidance for Site Investigation and Remediation (May 2010)*, including an examination of source location, current and historical use(s), and any applicable documentation. Material from industrial sites, spill sites, environmental remediation sites or other potentially contaminated sites will not be imported to the Site.

The following potential sources may be used pending attainment of backfill and cover soil quality objectives:

- Clean soil from construction projects at non-industrial sites in compliance with applicable laws and regulations;
- Clean soil from roadway or other transportation-related projects in compliance with applicable laws and regulations;
- Clean recycled concrete aggregate (RCA) from facilities permitted or registered by the NYSDEC.
- All materials received for import to the Site will be approved by the remedial engineer and will be in compliance with provisions described in the EECPRP. The RAR will report the source of the fill, evidence that an inspection was performed on the source, chemical sampling results, frequency of testing, and a Site map indicating the locations where backfill or soil cover was placed.
- All material will be subject to source screening and chemical testing, as required.

Inspection of imported fill material will include visual, olfactory and PID screening for evidence of contamination. Materials imported to the Site will be subject to inspection, as follows:

- Trucks with imported fill material will be in compliance with applicable laws and regulations and will enter the Site at designated locations;
- Backfill material will be free of solid waste including pavement materials, debris, stumps, roots, and other organic matter, as well as ashes, oil, perishables or foreign matter.

Composite samples of imported material will be taken at a minimum frequency of one sample for every 500 cubic yards of material. Once it is determined that the fill material meets imported backfill or cover soil chemical requirements and is nonhazardous, and lacks petroleum contamination, the material will be loaded onto trucks for delivery to the Site.

Recycled concrete aggregate (RCA) will be imported from facilities permitted or registered by NYSDEC. Facilities will be identified in the RAR. The selected facility must be compliant with 6 NYCRR Part 360 registration and permitting requirements for the period of acquisition of RCA. RCA imported from compliant facilities will not require additional testing, unless required by NYSDEC under its terms for operation of the facility. To maintain exemption of sampling requirements, RCA imported to the Site must be derived from recognizable and uncontaminated concrete and contain less than 10% be weight passing a #80 sieve. RCA material is not acceptable for, and will not be used as cover material.

10.0 FLUIDS MANAGEMENT

All liquids to be removed from the Site, including dewatering fluids, will be handled, transported and disposed in accordance with applicable laws and regulations. Liquids discharged into the New York City sewer system will receive prior approval by New York City Department of Environmental Protection (NYCDEP). The NYCDEP regulates discharges to the New York City sewers under Title 15, Rules of the City of New York Chapter 19. Discharge to the New York City sewer system will require an authorization and sampling data demonstrating that the groundwater meets the City's discharge criteria. The dewatering fluid will be pretreated as necessary to meet the NYCDEP discharge criteria. If discharge to the City sewer system is not appropriate, the dewatering fluids will be managed by transportation and disposal of at an off-site treatment facility.

Discharge of water generated during remedial construction to surface waters (i.e. a stream or river) is prohibited without a State Pollutant Discharge Elimination System (SPDES) permit, issued by New York State Department of Environmental Conservation.

11.0 STORMWATER POLLUTION PREVENTION

Applicable laws and regulations pertaining to stormwater pollution prevention will be addressed during construction. Erosion and sediment control measures identified in the EECPRP (silt fences and barriers, and hay bale checks) will be installed around the entire perimeter of the construction area and inspected weekly and after every storm event to ensure that they are operating appropriately. Discharge locations will be inspected to determine whether erosion control measures are effective at preventing significant impacts to receptors. Results of inspections will be recorded in a logbook and maintained at the Site and available for inspection by the NYSDEC and OER. All necessary repairs shall be made immediately. Accumulated sediments will be removed as required to keep the barrier and hay bale check functional. Undercutting or erosion of the silt fence toe anchor will be repaired immediately with appropriate backfill materials. Manufacturer's recommendations will be followed for replacing silt fencing damaged by weathering.

12.0 CONTINGENCY PLAN FOR UNKNOWN CONTAMINATION SOURCES

This contingency plan is developed for the construction to address the discovery of unknown structures or contaminated media during excavation. Identification of unknown contamination source areas during invasive Site work will be promptly communicated to the NYSDEC Project Manager. Petroleum spills will be reported to the NYSDEC Spill Hotline. These findings will be included in the daily report.

Although not expected, previously unknown underground storage tanks (UST) that are discovered during development-related excavation will be handled, cleaned, and removed in accordance with 6 NYCRR Part 375 Section 5.5 (Underground Storage Tank Closure).

13.0 ODOR, DUST, AND NUISANCE CONTROL

13.1 Odor Control

All necessary means will be employed to prevent on- and off-site odor nuisances. At a minimum, procedures will include:

- limiting the area of open excavations;
- shrouding open excavations with tarps and other covers; and
- use of foams to cover exposed, odorous soils.

If odors develop and cannot otherwise be controlled, additional means to eliminate odor nuisances will include direct load-out of soil for off-site disposal and use of chemical odorants in spray or misting systems.

This odor control plan is capable of controlling emissions of nuisance odors. If nuisance odors are identified, work will be halted and the source of odors will be identified and corrected. Work will not resume until all nuisance odors have been abated. The NYSDEC and OER will be notified of odor complaint events. Implementation of all odor controls, including halt of work, will be the responsibility of the PE/QEP's certifying the EECPRP, the Project Manager, and the Health and Safety Office (HSO), under guidance from the PE/QEP.

13.2 Dust Control

Dust management during invasive on-site work will include, at a minimum:

- Use of a dedicated water spray methodology for roads, excavation areas and stockpiles.
- Use of properly anchored tarps to cover stockpiles.
- Exercise extra care during dry and high-wind periods.
- Use of gravel or recycled concrete aggregate on egress and other roadways to provide a clean and dust-free road surface.

This dust control plan is capable of controlling emissions of dust. If nuisance dust emissions are identified, work will be halted and the source of dusts will be identified and corrected. Work will not resume until all nuisance dust emissions have been abated. The NYSDEC and OER will be notified of dust complaint events. Implementation of all dust controls, including halt of work, will be the responsibility of the PE/QEP's certifying the EECPRP, the Project Manager, and the HSO.

13.3 Other Nuisances

Noise control will be exercised during construction. All remediation-related construction work will conform, at a minimum, to NYC noise control standards.

Rodent control will be provided during Site clearing and grubbing and during construction, as necessary, to prevent nuisances.

APPENDIX C

Vapor Barrier Specifications

PREPRUFE® 300R & 160R

Pre-applied waterproofing membranes that bond integrally to poured concrete for use below slabs or behind basement walls on confined sites

Description

Preprufe® 300R & 160R membranes are unique composite sheets comprised of a thick HDPE film, pressure sensitive adhesive and weather resistant protective coating. Designed with Advanced Bond Technology™, Preprufe 300R & 160R membranes form a unique, integral bond to poured concrete, preventing both the ingress and lateral migration of water while providing a robust barrier to water, moisture and gas.

The Preprufe R System includes:

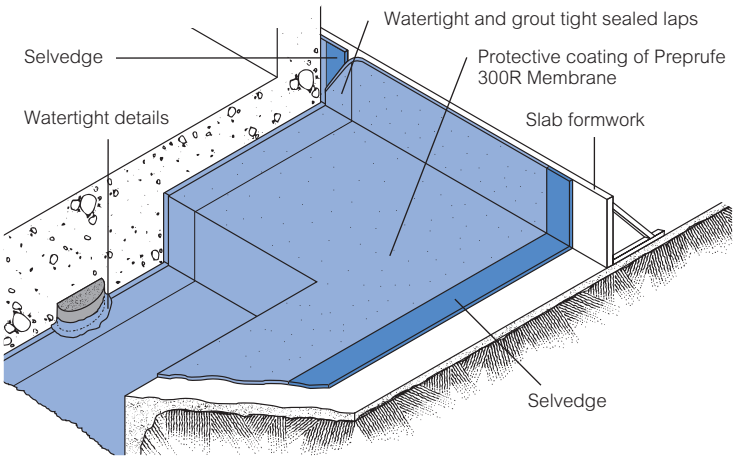
- **Preprufe® 300R**—heavy-duty grade for use below slabs and on rafts (i.e. mud slabs). Designed to accept the placing of heavy reinforcement using conventional concrete spacers.
- **Preprufe® 160R**—thinner grade for blindside, zero property line applications against soil retention systems.Vertical use only.
- **Preprufe® Tape LT**—for covering cut edges, roll ends, penetrations and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C)).
- **Preprufe® Tape HC**—for covering cut edges, roll ends, penetrations and detailing (minimum 50°F (10°C)).
- **Preprufe® CJ Tape LT**—for construction joints, and detailing (temperatures between 25°F (-4°C) and 86°F (+30°C)).
- **Preprufe® CJ Tape HC**—for construction joints, and detailing (minimum 50°F (10°C)).
- **Bituthene® Liquid Membrane**—for sealing around penetrations, etc.
- **Adcor™ ES**—waterstop for joints in concrete walls and floors
- **Preprufe® Tieback Covers**—preformed cover for soil retention wall tieback heads
- **Preprufe® Preformed Corners**—preformed inside and outside corners

Preprufe® 300R & 160R membranes are applied either horizontally to smooth prepared concrete, carton forms or well rolled and compacted earth or crushed stone substrate; or vertically to permanent formwork or adjoining structures. Concrete is then cast directly against the adhesive side of the membranes. The specially developed Preprufe adhesive layers work together to form a continuous and integral seal to the structure.

Preprufe® products can be returned up the inside face of slab formwork but is not recommended for conventional twin-sided formwork on walls, etc. Use Bituthene® self-adhesive membrane or Procor® fluid-applied membrane to walls after removal of formwork for a fully bonded system to all structural surfaces.

Advantages

- **Forms a unique continuous adhesive bond to concrete poured against it**—prevents water migration and makes it unaffected by ground settlement beneath slabs
- **Fully-adhered watertight laps** and detailing
- **Provides a barrier to water, moisture and gas**—physically isolates the structure from the surrounding ground
- **BBA Certified** for basement Grades 2, 3, & 4 to BS 8102:1990
- **Zero permeance** to moisture
- **Solar reflective**—reduced temperature gain
- **Simple and quick to install**—requiring no priming or fillets
- **Can be applied to permanent formwork**—allows maximum use of confined sites
- **Self protecting**—can be trafficked immediately after application and ready for immediate placing of reinforcement
- **Unaffected by wet conditions**—cannot activate prematurely
- **Inherently waterproof, non-reactive system:**



Drawings are for illustration purposes only.
Please refer to graceconstruction.com for specific application details.

BBA BRITISH BOARD OF AGREMENT CERTIFICATE No. 97/3325

- not reliant on confining pressures or hydration
- unaffected by wet/dry cycling

- **Chemical resistant**—effective in most types of soils and waters, protects structure from salt or sulphate attack

Installation

The most current application instructions, detail drawings and technical letters can be viewed at graceconstruction.com. For other technical information contact your local Grace representative.

Preprufe® 300R & 160R membranes are supplied in rolls 4 ft (1.2 m) wide, with a selvedge on one side to provide self-adhered laps for continuity between rolls. The rolls of Preprufe Membrane and Preprufe Tape are interwound with a disposable plastic release liner which must be removed before placing reinforcement and concrete.

Substrate Preparation

All surfaces—It is essential to create a sound and solid substrate to eliminate movement during the concrete pour. Substrates must be regular and smooth with no gaps or voids greater than 0.5 in. (12 mm). Grout around all penetrations such as utility conduits, etc. for stability (see Figure 1).

Horizontal—The substrate must be free of loose aggregate and sharp protrusions. Avoid curved or rounded substrates. When installing over earth or crushed stone, ensure substrate is well compacted to avoid displacement of substrate due to traffic or concrete pour. The surface does not need to be dry, but standing water must be removed.

Vertical—Use concrete, plywood, insulation or other approved facing to sheet piling to provide support to the membrane. Board systems such as timber lagging must be close butted to provide support and not more than 0.5 in. (12 mm) out of alignment.

Membrane Installation

Preprufe® membranes can be applied at temperatures of 25°F (-4°C) or above. When installing Preprufe product in cold or marginal weather conditions 55°F (<13°C) the use of Preprufe Tape LT is recommended at all laps and detailing. Preprufe Tape LT should be applied to clean, dry surfaces and the release liner must be removed immediately after application. Alternatively, Preprufe Low Temperature (LT) membrane is available for low temperature condition applications. Refer to Preprufe LT data sheet and Grace Tech Letter 16 for more information.

Horizontal substrates—Place the membrane HDPE film side to the substrate with the clear plastic release liner facing towards the concrete pour. End laps should be staggered to avoid a build up of layers. Leave plastic release liner in position until overlap procedure is completed (see Figure 2).

Accurately position succeeding sheets to overlap the previous sheet 3 in. (75 mm) along the marked selvedge. Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Peel back the plastic release liner from between the overlaps as the two layers are bonded together. Ensure a continuous bond is achieved without creases and roll firmly with a heavy roller. Completely remove the plastic liner to expose the protective coating. Any initial tack will quickly disappear products.

Refer to Grace Tech Letter 15 for information on suitable rebar chairs for Preprufe products.

Vertical substrates—Mechanically fasten the membrane vertically using fasteners appropriate to the substrate with the the clear plastic release liner facing towards the concrete pour. The membrane may be installed in any convenient length. Fastening can be made through the selvedge using a small and low profile head fastener so that the membrane lays flat and allows firmly rolled overlaps. Immediately remove the plastic release liner.

Ensure the underside of the succeeding sheet is clean, dry and free from contamination before attempting to overlap. Roll firmly to ensure a watertight seal.

Roll ends and cut edges—Overlap all roll ends and cut edges by a minimum 3 in. (75 mm) and ensure the area is clean and free from contamination, wiping with a damp cloth if necessary. Allow to dry and apply Preprufe® Tape LT (or HC in hot climates) centered over the lap edges and roll firmly (see Figure 3). Immediately remove printed plastic release liner from the tape.

Details

Detail drawings are available at graceconstruction.com.

Membrane Repair

Inspect the membrane before installation of reinforcement steel, formwork and final placement of concrete. The membrane can be easily cleaned by power washing if required. Repair damage by wiping the area with a damp cloth to ensure the area is clean and free from dust, and allow to dry. Repair small punctures (0.5 in. (12 mm) or less) and slices by applying Preprufe® Tape centered over the damaged area. Repair holes and large punctures by applying a patch of Preprufe membrane, which extends 6 in. (150 mm) beyond the damaged area. Seal all edges of the patch with Preprufe Tape. Any areas of damaged adhesive should be covered with Preprufe Tape. Where exposed selvedge has lost adhesion or laps have not been sealed, ensure the area is clean and dry and cover with fresh Preprufe Tape. All Preprufe Tape must be rolled firmly and the tinted release liner removed. Alternatively, use a hot air gun or similar to activate the adhesive using caution not to damage the membrane and firmly roll lap to achieve continuity.

Pouring of Concrete

Ensure the plastic release liner is removed from all areas of Preprufe membrane and tape.

It is recommended that concrete be poured within 56 days (42 days in hot climates) of application of the membrane. Following proper ACI guidelines, concrete must be placed carefully and consolidated properly to avoid damage to the membrane. Never use a sharp object to consolidate the concrete.

Removal of Formwork

Preprufe® membranes can be applied to removable formwork, such as slab perimeters, elevator and lift pits, etc. Once the concrete is poured the formwork must remain in place until the concrete has gained sufficient compressive strength to develop the surface bond. Preprufe membranes are not recommended for conventional twin-sided wall forming systems, see Grace Tech Letter 13 for information on forming systems used with Preprufe products.

Figure 1

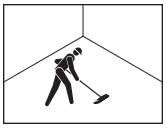


Figure 2

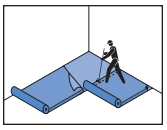
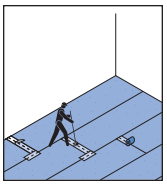
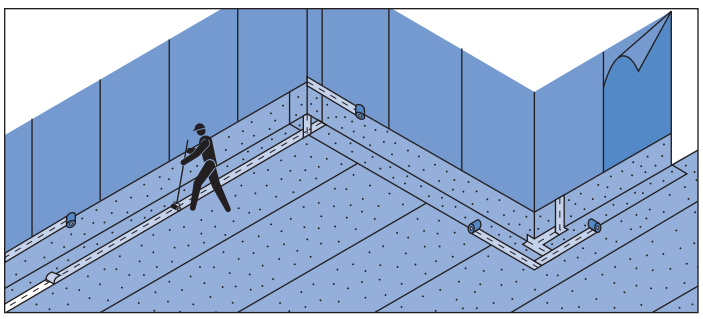


Figure 3

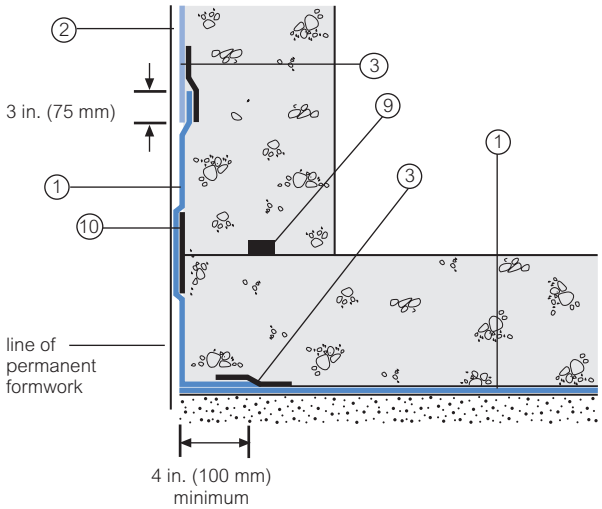




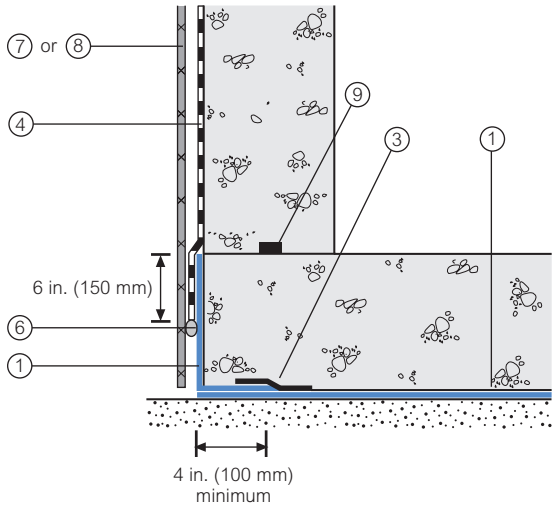
Detail Drawings

Details shown are typical illustrations and not working details. For a list of the most current details, visit us at graceconstruction.com. For technical assistance with detailing and problem solving please call toll free at 866-333-3SBM (3726).

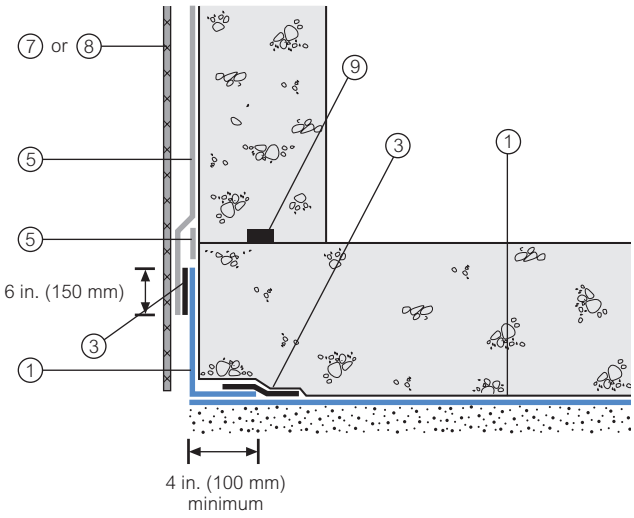
Wall base detail against permanent shutter



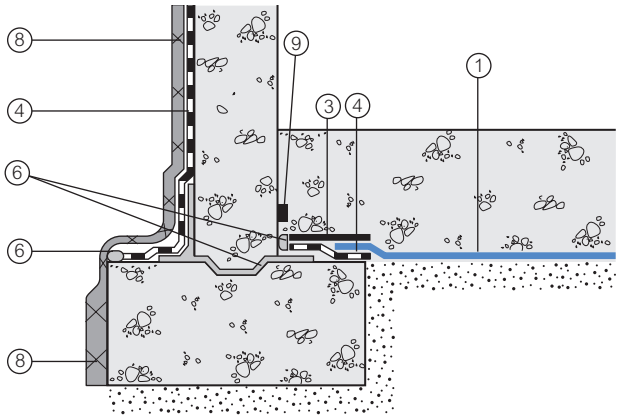
Bituthene® wall base detail (Option 1)



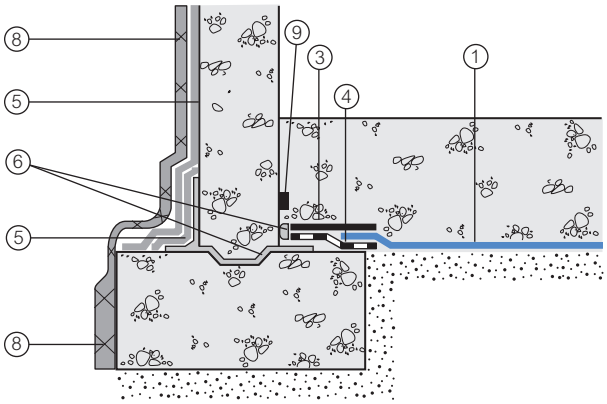
Procor® wall base detail (Option 1)



Bituthene® wall base detail (Option 2)



Procor® wall base detail (Option 2)



1 Preprufe® 300R
2 Preprufe® 160R
3 Preprufe® Tape
4 Bituthene®
5 Procor®
6 Bituthene® Liquid Membrane
7 Approved Protection Course
8 Hydroduct®
9 Adcor™ ES
10 Preprufe® CJ Tape

Supply

Dimensions (Nominal)	Preprufe 300R Membrane	Preprufe 160R Membrane	Preprufe Tape (LT or HC*)
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	
Roll size	4 ft x 98 ft (1.2 m x 30 m)	4 ft x 115 ft (1.2 m x 35 m)	4 in. x 49 ft (100 mm x 15 m)
Roll area	392 ft² (36 m²)	460 ft² (42 m²)	
Roll weight	108 lbs (50 kg)	92 lbs (42 kg)	4.3 lbs (2 kg)
Minimum side/end laps	3 in. (75 mm)	3 in. (75 mm)	3 in. (75 mm)

Physical Properties

Property	Typical Value 300R	Typical Value 160R	Test Method
Color	white	white	
Thickness	0.046 in. (1.2 mm)	0.032 in. (0.8 mm)	ASTM D3767
Lateral Water Migration Resistance	Pass at 231 ft (71 m) of hydrostatic head pressure	Pass at 231 ft (71 m) of hydrostatic head pressure	ASTM D5385, modified[1]
Low temperature flexibility	Unaffected at -20°F (-29°C)	Unaffected at -20°F (-29°C)	ASTM D1970
Resistance to hydrostatic head	231 ft (71 m)	231 ft (71 m)	ASTM D5385, modified[2]
Elongation	500%	500%	ASTM D412, modified[3]
Tensile strength, film	4000 psi (27.6 MPa)	4000 psi (27.6 MPa)	ASTM D412
Crack cycling at -9.4°F (-23°C), 100 cycles	Unaffected, Pass	Unaffected, Pass	ASTM C836
Puncture resistance	221 lbs (990 N)	100 lbs (445 N)	ASTM E154
Peel adhesion to concrete	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D903, modified[4]
Lap peel adhesion	5 lbs/in. (880 N/m)	5 lbs/in. (880 N/m)	ASTM D1876, modified[5]
Permeance to water vapor transmission	0.01 perms (0.6 ng/(Pa x s x m²))	0.01 perms (0.6 ng/(Pa x s x m²))	ASTM E96, method B
Water absorption	0.5%	0.5%	ASTM D570

Footnotes:

1. Lateral water migration resistance is tested by casting concrete against membrane with a hole and subjecting the membrane to hydrostatic head pressure with water. The test measures the resistance of lateral water migration between the concrete and the membrane.
2. Hydrostatic head tests of Preprufe Membranes are performed by casting concrete against the membrane with a lap. Before the concrete cures, a 0.125 in. (3 mm) spacer is inserted perpendicular to the membrane to create a gap. The cured block is placed in a chamber where water is introduced to the membrane surface up to the head indicated.
3. Elongation of membrane is run at a rate of 2 in. (50 mm) per minute.
4. Concrete is cast against the protective coating surface of the membrane and allowed to properly dry (7 days minimum). Peel adhesion of membrane to concrete is measured at a rate of 2 in. (50 mm) per minute at room temperature.
5. The test is conducted 15 minutes after the lap is formed (per Grace published recommendations) and run at a rate of 2 in. (50 mm) per minute.

Removal of Formwork (continued)

A minimum concrete compressive strength of 3000 psi (20 N/mm²) is recommended prior to stripping formwork supporting Preprufe® membranes. Premature stripping may result in displacement of the membrane and/or spalling of the concrete.

Refer to Grace Tech Letter 17 for information on removal of formwork for Preprufe products.

Specification Clauses

Preprufe 300R® or 160R membrane shall be applied with its protective coating presented to receive fresh concrete to which it will integrally bond. Only Grace Construction Products approved membranes shall be bonded to Preprufe 300R/160R product. All Preprufe 300R/160R system materials shall be supplied by Grace Construction Products, and applied strictly in accordance with their instructions. Specimen performance and formatted clauses are also available.

NOTE: Use Preprufe Tape to tie-in Procor® fluid-applied membrane with Preprufe® products.

Health and Safety

Refer to relevant Material Safety data sheet. Complete rolls should be handled by a minimum of two persons.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

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GRACE

BITUTHENE® SYSTEM 4000

Self-adhesive HDPE waterproofing membrane with super tacky compound for use with patented, water-based Bituthene® System 4000 Surface Conditioner

Description

Bituthene® System 4000 WaterProofing Membrane is a 1/16 in. (1.5 mm) flexible, pre-formed membrane which combines a high performance, cross laminated, HDPE carrier film with a unique, super tacky, self-adhesive rubberized asphalt compound.

Bituthene® System 4000 Surface Conditioner is a unique, water-based, latex surface treatment which imparts an aggressive, high tack finish to the treated substrate. It is specifically formulated to bind site dust and concrete efflorescence, thereby providing a suitable surface for the Bituthene® System 4000 Waterproofing Membrane.

Conveniently packaged in each roll of membrane, System 4000 Surface Conditioner promotes good initial adhesion and, more importantly, excellent permanent adhesion of the Bituthene® System 4000 Waterproofing Membrane. The VOC (Volatile Organic Compound) content of this product is 91 g/L.

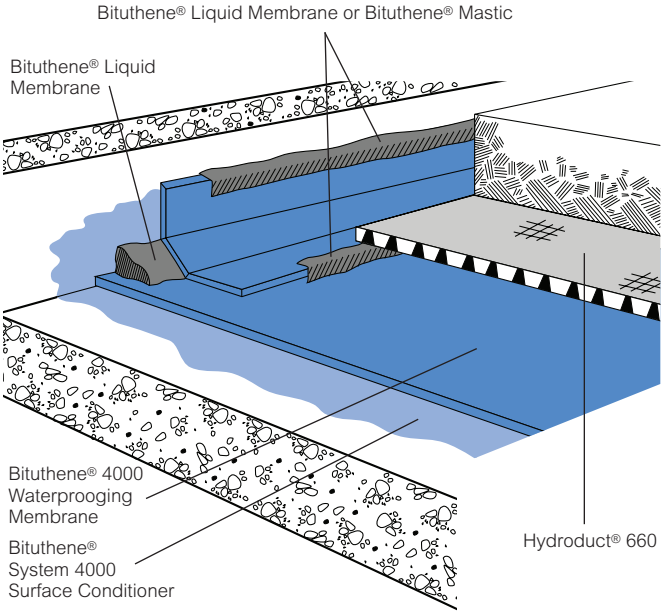
Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at graceconstruction.com for most current list of allowable limits.

Advantages

- **Excellent adhesion**—special adhesive compound engineered to work with high tack System 4000 Surface Conditioner
- **Cold applied**—simple application to substrates, especially at low temperatures
- **Reduced inventory and handling costs**— Bituthene® System 4000 Surface Conditioner is included with each roll of membrane
- **Wide application temperature range**—excellent bond to self and substrate from 25°F (-4°C) and above
- **Overlap security**—minimizes margin for error under site conditions

Product Advantages

- Excellent adhesion
- Cold applied
- Reduced inventory and handling costs
- Wide application temperature range
- Overlap security
- Cross laminated, high density polyethylene carrier film
- Flexible
- UL approval Class A Fire Rating
- Ripcord®



Drawings are for illustration purposes only.
Please refer to graceconstruction.com for specific application details.

- **Cross laminated, high density polyethylene carrier film—**provides high tear strength, puncture and impact resistance
- **Flexible—**accommodates minor structural movements and will bridge shrinkage cracks
- **UL approval Class A Fire Rating—**see approvals section inside for details
- **Ripcord®—**this split release on demand feature allows the splitting of the membrane into two (2) pieces for ease of installation in detailed areas

Use

Bituthene® membrane is ideal for waterproofing concrete decks where in-service temperatures will not exceed 130°F (54°C). It can be applied to split slab construction such as in plaza areas and parking decks. Interior uses may include mechanical rooms, laboratories, kitchens and bathrooms. (For below grade applications, see *Below Grade Waterproofing Bituthene® System 4000*.)

Bituthene® waterproofing membrane is 1/16 in. (1.5 mm) thick, 3 ft (0.9 m) wide and 66.7 ft (20 m) long and is supplied in rolls. It is unrolled adhesive side down onto concrete slabs primed with Bituthene® System 4000 Surface Conditioner. Continuity is achieved by overlapping a minimum 2 in. (50 mm) and firmly rolling the joint.

Bituthene® membrane is extremely flexible. It is capable of bridging shrinkage cracks in the concrete and will accommodate minor differential movement throughout the service life of the structure.

Application Procedures

Safety, Storage and Handling Information

Bituthene® products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable.

For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

Surfaces should be structurally sound and free of voids, spalled areas, loose aggregate and sharp protrusions. Remove contaminants such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Concrete must be properly dried (minimum 7 days for normal structural concrete and 14 days for lightweight structural concrete). **If time is critical, Bituthene® Primer B2 or Bituthene® Primer B2 LVC may be used to allow priming and installation of membrane on damp surfaces or green concrete. Priming may begin in this case as soon as the concrete will maintain structural integrity.** Use form release agents which will not transfer to the concrete. Remove forms as soon as possible from below horizontal slabs to prevent entrapment of excess moisture. Excess moisture may lead to blistering of the membrane. Cure concrete with clear, resin-based curing compounds which do not contain oil, wax or pigment. Except with Bituthene® Primer B2 or Bituthene® Primer B2 LVC, allow concrete to thoroughly dry following rain. Do not apply any products to frozen concrete.

Repair defects such as spalled or poorly consolidated areas. Remove sharp protrusions and form match lines. For rough or uneven surfaces use Bituthene® Deck Prep® waterproofing membrane as a repair and leveling agent. See *Bituthene® Deck Prep®* waterproofing membrane product information sheet for details. On masonry surfaces, apply a parge coat to rough concrete block and brick walls or trowel cut mortar joints flush to the face of the concrete blocks.

Temperature

- Apply Bituthene® System 4000 Membrane and Conditioner only in dry weather and when air and surface temperatures are 25°F (-4°C) or above.
- Apply Bituthene® Primer B2 in dry weather above 25°F (-4°C). (See separate product information sheet.)

Conditioning

Bituthene® System 4000 Surface Conditioner is ready to use and can be applied by spray or roller. For best results, use a pump-type air sprayer with fan tip nozzle, like the Bituthene® System 4000 Surface Conditioner Sprayer, to apply the surface conditioner.

Apply Bituthene® System 4000 Surface Conditioner to clean, dry, frost-free surfaces at a coverage rate of 300 ft^2/gal (7.4 m^2/L). Coverage should be uniform. Surface conditioner should not be applied so heavily that it puddles or runs. **Do not apply conditioner to Bituthene® membrane.**

Allow Bituthene® System 4000 Surface Conditioner to dry one hour or until substrate returns to its original color. At low temperatures or in high humidity conditions, dry time may be longer.

Bituthene® System 4000 Surface Conditioner is clear when dry and may be slightly tacky. In general, conditioning should be limited to what can be covered within 24 hours. In situations where long dry times may prevail, substrates may be conditioned in advance. Substrates should be reconditioned if significant dirt or dust accumulates.

Before surface conditioner dries, tools should be cleaned with water. After surface conditioner dries, tools should be cleaned with mineral spirits. Mineral spirits is a combustible liquid which should be used only in accordance with manufacturer's recommendations. **Do not use solvents to clean hands or skin.**

Bituthene® System 4000 Surface Conditioner Sprayer

The Bituthene® System 4000 Surface Conditioner Sprayer is a professional grade, polyethylene, pump-type, compressed air sprayer with a brass fan tip nozzle. It has a 2 gal (7.6 L) capacity. The nozzle orifice and spray pattern have been specifically engineered for the optimum application of Bituthene® System 4000 Surface Conditioner.

Hold nozzle 18 in. (450 mm) from substrate and squeeze handle to spray. Spray in a sweeping motion until substrate is uniformly covered.

Sprayer should be repressurized by pumping as needed. For best results, sprayer should be maintained at high pressure during spraying.

To release pressure, invert the sprayer and spray until all compressed air is released.

Maintenance

The Bituthene® System 4000 Surface Conditioner Sprayer should perform without trouble for an extended period if maintained properly.

Sprayer should not be used to store Bituthene® System 4000 Surface Conditioner. The sprayer should be flushed with clean water immediately after spraying. For breaks in the spray operation of one hour or less, invert the sprayer and squeeze the spray handle until only air comes from the nozzle. This will avoid clogging.

Should the sprayer need repairs or parts, call the maintenance telephone number on the sprayer tank (800-323-0620).

Corner Details

The treatment of corners varies depending on the location of the corner. For detailed information on Bituthene® Liquid Membrane, see separate product information sheet.

- At plaza deck to wall inside corners—
  Option 1: Apply membrane on wall and deck to within 1 in. (25 mm) of corner. Treat the inside corner by installing a ¾ in. (20 mm) fillet of Bituthene® Liquid Membrane. Extend Bituthene® Liquid Membrane at least 2½ in. (65 mm) onto deck membrane, and 2½ in. (65 mm) onto wall membrane. Terminate top of wall flashing with Bituthene® Mastic, Bituthene® Liquid Membrane or termination bar.

  Option 2: Apply membrane on deck to within 1 in. (25 mm) of corner. Treat the inside corner by installing a ¾ in. (20 mm) fillet of Bituthene® Liquid Membrane. Extend Bituthene® Liquid Membrane at least 2½ in. (65 mm) onto wall.

  Option 3: Apply membrane on deck to within 1 in. (25 mm) of corner. Treat the inside corner by installing a ¾ in. (20 mm) fillet of Bituthene® Liquid Membrane. Apply membrane flashing sheet on wall, over fillet and 6 in. (150 mm) onto deck membrane. Apply 1 in. (25 mm) wide troweling of Bituthene® Mastic or Bituthene® Liquid Membrane over all terminations and seams within 12 in. (300 mm) of corner. Terminate top of wall flashing with mastic, Bituthene® Liquid Membrane or termination bar.
- In planters, reflecting pools and fountains, apply membrane on wall and deck to within 1 in. (25 mm) of corner. Treat the inside corner by installing a ¾ in. (20 mm) fillet of Bituthene® Liquid Membrane. Extend Bituthene® Liquid Membrane at least 2½ in. (65 mm) onto deck membrane, and 2½ in. (65 mm) onto wall membrane. Terminate top of wall membrane with Bituthene® Liquid Membrane or termination bar.
- Wall to wall inside corner, apply 12 in. (300 mm) sheet membrane strip centered on corner. Press membrane tightly into corner to assure full contact. Cover the treated corner with a full sheet of membrane to ensure 2-ply coverage.
- Outside corners, apply 12 in. (300 mm) sheet membrane strip centered on corner. Cover the treated corner with a full sheet of membrane to ensure 2-ply coverage.

Expansion Joints in Concrete Construction

Bituthene® membrane is not an expansion joint filler or sealant, but may be used as an expansion joint cover only in limited, special situations, as shown in Figures 1 and 2.

To adequately waterproof an expansion joint requires the use of materials specifically designed to do that job. Bituthene® waterproofing systems can, in most cases, be tied into expansion joint waterproofing and/or covering systems to provide full waterproofing protection on a project.

Project designers and/or contractors should consult with expansion joint sealant and covering manufacturers for design and installation details. A partial listing of manufacturers is included in Technical Letter 11. Also, Section 05800 of Sweets, *Expansion Control*, and Section 07920, *Sealant and Caulking*, provide information on manufacturers and design possibilities.

Designers should consider using gutters under critical expansion joints to provide a second line of defense against seal failure.

Use of Bituthene® Membrane as an Expansion Joint Cover

Figures 1 and 2 illustrate the use of Bitu-thene® membrane as an expansion joint cover.

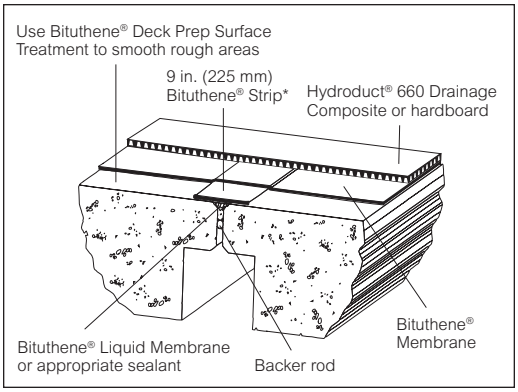


Figure 1 Passive Joint Cover

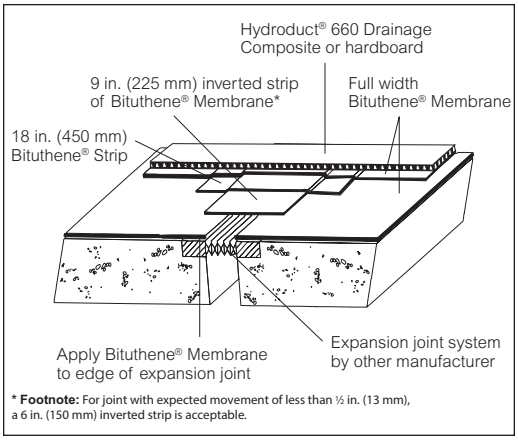


Figure 2 Active Movement Joint

Joints

Properly seal all joints with waterstop, joint filler and sealant as required. Bituthene® membranes are not intended to function as the primary joint seal. Allow sealants to fully cure. Pre-strip all slab and wall cracks over 1/16 in. (1.5 mm) wide and all construction and control joints with 9 in. (230 mm) wide sheet membrane strip.

Application on Horizontal Surfaces

Apply membrane from the low point to the high point so that laps shed water. Overlap all seams at least 2 in. (50 mm). Stagger all end laps. Roll the entire membrane firmly and completely as soon as possible. Use a linoleum roller or standard water-filled garden roller less than 30 in. (760 mm) wide, weighing a minimum of 75 lbs (34 kg) when filled. Cover the face of the roller with a resilient material such as a ½ in. (13 mm) plastic foam or two wraps of indoor-outdoor carpet to allow the membrane to fully contact the primed substrate. Seal all T-joints and membrane terminations with Bituthene® Liquid Membrane at the end of the day.

Protrusions and Drains

Apply membrane to within 1 in. (25 mm) of the base of the protrusion. Apply Bituthene® Liquid Membrane 0.1 in. (2.5 mm) thick around protrusion. Bituthene® Liquid Membrane should extend over the membrane a minimum of 2½ in. (65 mm) and up the penetration to just below the finished height of the wearing course.

Flood Testing

Flood test all horizontal applications with a minimum 2 in. (51 mm) head of water for 24 hours. Mark any leaks and repair when the membrane is dry. Before flood testing, be sure the structure will withstand the dead load of the water. For well-sloped decks, segment the flood test to avoid deep water near drains.

Conduct the flood test 24 hours after completing the application of Bituthene® waterproofing system. Immediately after flood test is completed, and all necessary repairs made, install Hydroduct® 660 Drainage Composite to protect the Bituthene® membrane from traffic and other trades.

Membrane Repairs

Patch tears and inadequately lapped seams with membrane. Clean membrane with a damp cloth and dry. Slit fishmouths and repair with a patch extending 6 in. (150 mm) in all directions from the slit and seal edges of the patch with Bituthene® Liquid Membrane. Inspect the membrane thoroughly before covering and make any repairs.

Drainage

Hydroduct® drainage composites are recommended for both active drainage and protection of the membrane. See Hydroduct® product information sheets.

Protection of Membrane

Protect Bituthene® membranes to avoid damage from other trades, construction materials or finishes. Place protection immediately in temperatures above 77°F (25°C) to avoid potential for blisters.

- On horizontal applications, exposed to construction traffic, use Hydroduct® 660 Drainage Composite. Adhere as necessary to membrane with Preprufe® Detail Tape. Alternate methods of protection are to use ⅛ in. (3 mm) or ¼ in. (6 mm) asphalt hardboard. In mud slab waterproofing, or other applications where positive drainage is not desired, and where reinforced concrete slabs are placed over the membrane, the use of ¼ in. (6 mm) hardboard or 2 layers of ⅛ in. (3 mm) hardboard is recommended.
- Cover any exposed Bituthene® membranes with weather resistant flashing such as copper, aluminum or neoprene. Install protection the same day the membrane is applied or immediately after 24 hour flood testing. No waiting before backfill or application of wearing course is necessary.

Insulation

Always apply Bituthene® membrane directly to primed or conditioned structural substrates. Insulation, if used, must be applied over the membrane. Do not apply Bituthene® membranes over lightweight insulating concrete.

Approvals

- City of Los Angeles Research Report RR 24386
- U.S. Department of Housing and Urban Development (HUD) HUD Materials Release 628E
- Bituthene® System 4000 Membrane carries an Underwriters' Laboratory Class A Fire Rating (Building Materials Directory, File #R7910) when used in either of the following constructions:
  - —Limited to noncombustible decks at inclines not exceeding ¼ in. (6 mm) to the horizontal 1 ft (0.3 m). One layer of Bituthene® waterproofing membrane, followed by one layer of ⅛ in. (3 mm) protection board, encased in 2 in. (50 mm) minimum concrete monolithic pour.
  - —Limited to noncombustible decks at inclines not exceeding ¼ in. (6 mm) to the horizontal 1 ft (0.3 m). One layer of Bituthene® waterproofing membrane, followed by one layer of DOW Styrofoam PD Insulation Board [2 in. (50 mm) thick]. This is covered with one layer of 2 ft x 2 ft x 2 in. (0.6 m x 0.6 m x 50 mm) concrete paver topping.

Warranty

Five year material warranties covering Bituthene® and Hydroduct® products are available upon request. Contact your Grace sales representative for details.

Technical Services

Support is provided by full time, technically trained Grace representatives and technical service personnel, backed by a central research and development staff.

Supply

Bituthene® System 4000	3 ft x 66.7 ft roll (200 ft²) [0.9 m x 20 m (18.6 m²)]
Roll weight	83 lbs (38 kg) gross
Palletization	25 rolls per pallet
Storage	Store upright in dry conditions below 95°F (+35°C).
System 4000 Surface Conditioner	1 x 0.625 gal (2.3 L) bottle in each roll of System 4000 Membrane
Ancillary Products	
Surface Conditioner Sprayer	2 gal (7.6 L) capacity professional grade sprayer with specially engineered nozzle
Bituthene® Liquid Membrane	1.5 gal (5.7 L) pail/125 pails per pallet or 4 gal (15.1 L) pail/48 pails per pallet
Preprufe® Detail Tape	2 in. x 50 ft (50 mm x 15 m) roll/16 rolls per carton
Bituthene® Mastic	Twelve 30 oz (0.9 L) tubes/carton or 5 gal (18.9 L) pail/36 pails per pallet
Complementary Material	
Hydroduct®	See separate data sheets

Equipment by others: Soft broom, utility knife, brush or roller for priming

Physical Properties for Bituthene® System 4000 Waterproofing Membrane

Property	Typical Value	Test Method
Color	Dark gray-black	
Thickness	1/16 in. (1.5 mm) nominal	ASTM D3767—method A
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970
Tensile strength, membrane, die C	325 lbs/in.² (2240 kPa) minimum	ASTM D412 modified[1]
Tensile strength, film	5,000 lbs/in.² (34.5 MPa) minimum	ASTM D882 modified[1]
Elongation, ultimate failure of rubberized asphalt	300% minimum	ASTM D412 modified[1]
Crack cycling at -25°F (-32°C), 100 cycles	Unaffected	ASTM C836
Lap adhesion at minimum application temperature	5 lbs/in. (880 N/m)	ASTM D1876 modified[2]
Peel strength	9 lbs/in. (1576 N/m)	ASTM D903 modified[3]
Puncture resistance, membrane	50 lbs (222 N) minimum	ASTM E154
Resistance to hydrostatic head	231 ft (71 m) of water	ASTM D5385
Permeance	0.05 perms (2.9 ng/m²sPa) maximum	ASTM E96, section 12—water method
Water absorption	0.1% maximum	ASTM D570

Footnotes:
1. The test is run at a rate of 2 in. (50 mm) per minute.
2. The test is conducted 15 minutes after the lap is formed and run at a rate of 2 in. (50 mm) per minute at 40°F (5°C).
3. The 180° peel strength is run at a rate of 12 in. (300 mm) per minute.

Physical Properties for Bituthene® System 4000 Surface Conditioner

Property	Typical Value
Solvent type	Water
Flash point	>140°F (>60°C)
VOC* content	91 g/L
Application temperature	25°F (-4°C) and above
Freeze thaw stability	5 cycles (minimum)
Freezing point (as packaged)	14°F (-10°C)
Dry time (hours)	1 hour**

* Volatile Organic Compound
** Dry time will vary with weather conditions

www.graceconstruction.com

For additional information on Grace's Residential Waterproofing, call: 1-866-333-3SBM (3726)

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BITUTHENE® LIQUID MEMBRANE

Two component, elastomeric, liquid applied detailing compound for use with Grace waterproofing membranes

Description

Bituthene® Liquid Membrane is a two component, elastomeric, cold applied, trowel grade material designed for a variety of uses with the Grace waterproofing systems. The VOC (Volatile Organic Compound) content is 10 g/L.

Architectural and Industrial Maintenance Regulations limit the VOC content in products classified as Architectural Coatings. Refer to Technical Letters at graceconstruction.com for most current list of allowable limits.

Advantages

- **Liquid applied**—conforms to irregular profiles
- **Waterproof**—resistant to water vapor and water pressure
- **Tough, rubber-like**—flexible and damage resistant
- **Chemically cured**—unaffected by in-service temperature variations
- **Cold applied**—no flame hazard
- **System compatible**—formulated for use with Grace waterproofing membrane systems

Use

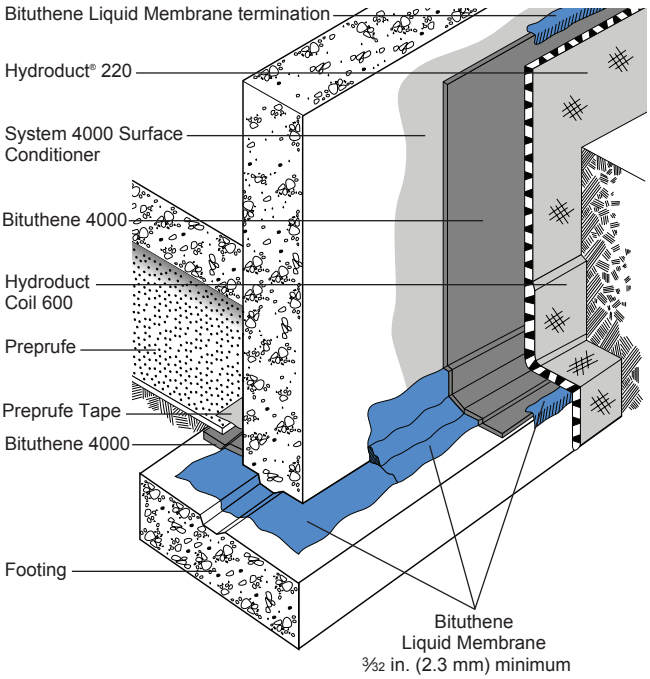
Bituthene® Liquid Membrane is ideally suited for the following uses:

- Fillet material at inside corners
- Reinforcement material at inside corners
- Flashing material around drains, protrusions, curbs and parapets
- Sealing material at terminations
- Repair material for defects on concrete surfaces
- Flashing material at corners

The two parts of Bituthene Liquid Membrane are mixed on site and troweled on to provide a simple and quick waterproofing detailing aid in conjunction with Bituthene, Preprufe® and Procor® systems.

Compatibility

Bituthene® Liquid Membrane is completely compatible with Bituthene, Preprufe and Procor, and with existing asphalt or coal tar-based waterproofing materials. It is also compatible with cured silicone and polyurethane sealants. It is not compatible with creosote, pentachlorophenol, linseed oil or polysulfide-based sealants.



Drawings are for illustration purposes only.
Please refer to graceconstruction.com for specific application details.

Product Advantages

- Liquid applied
- Waterproof
- Tough, rubber-like
- Chemically cured
- Cold applied
- System compatible

Supply

Bituthene® Liquid Membrane (Parts A & B)		
Unit size	1.5 gal (5.7 L)	4 gal (15.1 L)
Weight per unit	16 lbs (8 kg)	44 lbs (20 kg)
Units per pallet	100	24

Physical Properties

Property	Typical Value	Test Method
Color		
Part A	Black	
Part B	Clear	
Mixture of Parts A and B	Black	
Solids content	100%	ASTM D1644
Elongation	250% minimum	ASTM D412
Peel strength	5 lbs/in. (880 N/m) minimum	ASTM D903
Flexibility, 180° bend over 1 in. (25 mm) mandrel at -25°F (-32°C)	Unaffected	ASTM D1970

Application Procedures

Safety, Storage and Handling Information

Bituthene® products must be handled properly. Vapors from solvent-based primers and mastic are harmful and flammable. For these products, the best available information on safe handling, storage, personal protection, health and environmental considerations has been gathered. Material Safety Data Sheets (MSDS) are available at graceconstruction.com and users should acquaint themselves with this information. Carefully read detailed precaution statements on product labels and the MSDS before use.

Surface Preparation

All surfaces must be dry and free from dirt, grease, oil, dust or other contaminants. Bituthene® Liquid Membrane may be applied at temperatures of 25°F (-4°C) or above. Store in a dry place above 40°F.

Mixing

Add the entire contents of the Part B container to Part A and mix for 3 to 5 minutes until uniform. Part A is black and Part B is clear. Take care to scrape material from the side and bottom of the containers to assure thorough mixing. A low speed (150 rpm) mechanical mixer with flat paddle blades is required. Do not apply any material if streaks can be seen due to insufficient mixing.

Once mixed, Bituthene® Liquid Membrane must be applied by trowel within 1.5 hours. More time is available at lower temperatures. At high temperatures, thickening and curing will be faster. Material that has thickened must be discarded. The material will cure to a very flexible rubber-like material.

Bituthene Liquid Membrane must be applied at a minimum thickness of 3⁄32 in. (2.3 mm) unless otherwise noted on details. In fillet applications, the face of the fillet should be a minimum of ¾ in. (20 mm). In corner flashing application details, it should extend 6 in. (150 mm) in each direction from the corner. Bituthene Liquid Membrane will adhere to primed or unprimed concrete.

Bituthene Liquid Membrane should be allowed to cure at least 24 hours before flood testing.

Coverage

As a fillet material, 1 gal (3.8 L) will cover approximately 100 linear feet (30 m). As a flashing material, 1 gal (3.8 L) will cover approximately 17 ft^2 (1.6 m^2). As a fillet and reinforcement, 1 gal (3.8 L) will cover approximately 14 linear feet (4.3 m).

Cleaning

Clean tools and equipment with mineral spirits before Bituthene® Liquid Membrane has cured. Mineral spirits is a combustible liquid and should be used only in accordance with the manufacturer's safety recommendations. Do not use solvents to clean hands or skin.

www.graceconstruction.com

For technical assistance call toll free at 866-333-3SBM (3726)

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APPENDIX D

Construction Health and Safety Plan

CONSTRUCTION HEALTH AND SAFETY PLAN

76 ELEVENTH AVENUE
NEW YORK, NEW YORK 10011
NYSDEC BCP Site No. C231036
OER PROJECT No. 13EH-N304M

Prepared For:

76 Eleventh Avenue Property Owner, LLC
600 Madison Avenue
New York, NY 10022

Prepared By:

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

November 2015
100513101

LANGAN

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

1.0 INTRODUCTION

1.1 General

This Construction Health and Safety Plan (CHASP) has been developed by Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. (Langan) to comply with Occupational Safety and Health Administration (OSHA) Standard 29 CFR 1910.120(b)(4), Hazardous Waste Operations and Emergency Response (HAZWOPER). The CHASP addresses the planned development of the former Manufactured Gas Plan (MGP) property at 76 Eleventh Avenue in New York, New York (the "Site").

This site-specific CHASP is to be implemented by Langan personnel while on-site. Compliance with this site-specific CHASP is required of all Langan personnel who enter this area of site operations. The management of the day-to-day activities concerning this site and implementation of this site-specific CHASP in the field is the responsibility of the site Health and Safety Officer (HSO). Assistance in the implementation of this site-specific CHASP can also be obtained from the Langan Health and Safety Manager (HSM). The content of this site-specific CHASP may change or undergo revision based upon additional information made available to health and safety personnel, monitoring results, or changes in the scope of work. Any changes proposed must be reviewed by Health and Safety staff and are subject to the approval of the Langan HSM.

1.2 Project Background

76 Eleventh Avenue Property Owner, LLC is working with the New York City Office of Environmental Remediation (NYCOER) in the "E" Designation Program to satisfy the environmental requirements imposed on the 76,400-square foot site located at 76 Eleventh Avenue (the "Site"), in New York, New York. The E-designation (E-142) applies to Hazardous Materials and Noise and was assigned on June 23, 2005 subsequent to a City Environmental Quality Review (CEQR Number 03DCP069M) as part of the West Chelsea Rezoning.

The Site was enrolled in the New York State Brownfield Cleanup Program (NYSBCP) under Site No. C231036. Under the NYSBCP, the New York State Department of Environmental Conservation (NYSDEC) approved the 2011 Conceptual Remedial Action Work Plan (2011 C-RAWP) and 2012 Remedial Design (2012 RD). Pursuant to the "E" Designation, the 2011 C-RAWP and 2012 RD were submitted to the OER for review. The OER then assigned project number 13EH-N304M and issued a Notice of No Objection on July 16, 2013 to allow building permits to be issued for remediation.

Remediation was completed between October 2013 and July 2014 under the NYSDEC oversight and in accordance with the NYSDEC-approved 2012 Remedial Design. Following execution of an Environmental Easement and approval of the December 2014 Final Engineering Report (2014 FER) and Site Management Plan (2014 SMP), the NYSDEC issued a Certificate of Completion in December 2014. Upon completion of the remedy, the Site was left as a capped excavation. Prior to remediation, the Site was completely paved with an asphalt surface and used as a commercial parking lot. A portion of that parking lot has been restored.

During redevelopment, the NYSDEC will retain primary environmental oversight authority and work in concert with the NYCOER.

1.2.1 Site Location and Background

The 1.755-acre Site, identified as Block 689 and Lot 17 on the Manhattan Borough Tax Map, comprises the entire city block bounded by West 17th Street, West 18th Street, 10th Avenue, and Route 9A. The Site is relatively flat ranging from about elevation (el.) [1] 8 along Route 9A to about el. 10 along 10th Avenue. Topographic and Aerial Site Location Maps are provided as Figure 1 and Figure 2, respectively.

The Site is part of the Special West Chelsea zoning district, which was created by the City of New York to provide opportunities for new residential and commercial development. In addition, the recent renovation of the High Line (a former elevated rail line constructed between 1929 and 1934) by the NYC Parks and Recreation Department into an open space is part of the West Chelsea development project. The recently opened and heavily utilized NYC High Line Park (the High Line) traverses the Site from north to south along the eastern portion of the Site near 10th Avenue.

1.2.2 Summary of Redevelopment Plan

Based on available plans, the proposed development will consist of a podium and two multiple-story residential high-rise towers west of the High Line and a ground-level plaza east of the High Line. The podium, towers and plaza share a one-level basement that occupies about 59,261 square feet of building footprint and about 890,000 square feet of gross building area.

The two towers will require removal of the clean soil and stone cap to about ± el. 2.5 feet NAVD88, with deeper localized excavations in residual site soil and the ISS monolith for elevator pits, pile caps, and mat foundations. The foundation construction for the two towers

[1] Elevations referenced herein are to the North American Vertical Datum of 1988 (NAVD 88), which is about 1.083 feet above mean sea level and about 1.669 feet below Manhattan Borough Datum.

will consist of a 12- to 14-inch concrete slab for on-grade foundations and a 16-inch concrete pressure slab for subgrade cellar levels. The plaza area, beneath and east of the High Line, will require removal of the asphalt cover and excavation to ± el. -8 feet NAVD88 to accommodate the basement level, containing a 22-inch thick concrete pressure slab.

1.2.3 Environmental Background

Historical Operation and Land Use – Before Manufactured Gas Plant (MGP) Operations

The Site experienced little or no development prior to its use as an MGP, and the original shoreline of the Hudson River was at or near Tenth Avenue (in the vicinity of the Site). Once the eastern end of the block had been filled, the Manhattan Gas Light Company purchased the lots along West 18th Street and parts of 10th Avenue in 1833 from various owners. Concurrently, individuals bought lots and constructed five houses at the southeast end of the block, adjacent to the future location of the MGP facility. These houses remained until the late 1850s, when the gas company bought these lots and razed the houses to make room for additional MGP structures.

Historical Operation and Land Use – Manufactured Gas Plant Operations

MGP operations began at the West 18th Street Gas Works in 1834. During 1834, the Manhattan Gas Light Company purchased its initial property on the eastern end of Block 689 and began construction of the gas plant. The Manhattan Gas Light Company formed in 1830, and by 1834 was providing gas to all of Manhattan north of Grand and Canal Streets. The West 18th Street Gas Works was the second gas plant in the city, and the first such plant erected by the Manhattan Gas Light Company. Construction of the West 18th Street Gas Works began in fall 1833, and continued for the next year. By November 1834, the plant was manufacturing and distributing coal gas to customers.

During the nineteenth century, the West 18th Street Gas Works grew in size as the Manhattan Gas Light Company continued to purchase land and construct additional facility structures. The first property bought by the West 18th Street Gas Works was on the south side of West 18th Street, at the eastern end of Block 689. In 1858, the Manhattan Gas Light Company expanded the Retort House to include six groups of 160 retorts each, for a total of 960 retorts. To the west of the Retort House was a large coal house, where coal was stored after being unloaded from the adjacent waterfront pier. To the east of the Retort House was a laboratory along West 18th Street, and south of that, a building containing condensers, scrubbers and washers. Sanborn Maps as well as other historical maps depicting the former MGP features on Block 689 were included as appendices to the 2007 Remedial Investigation (RI) Report.

The West 18th Street Gas Works continued to operate through the final decades of the nineteenth century, although it did not acquire any additional land or change its configuration markedly during that period. The West 18th Street Gas Works appears to have operated only one or two years into the twentieth century.

Historical Operation and Land Use – After Manufactured Gas Plant Operations

Between 1909 and 1914, the remaining gas holders used during operation of the West 18th Street Works were demolished by the Consolidated Gas Company of New York, Inc. (Consolidated Gas Company), the successor by consolidation to the Manhattan Gas Light Company. During the 1910s, the Consolidated Gas Company began to sell the properties comprising the grounds of the West 18th Street Gas Works, marking the end of the MGP history for the Site. In 1936, the Consolidated Gas Company changed its name to Consolidated Edison Company of New York, Inc.

In 1917, the Consolidated Gas Company sold the entire Block 689 to the New York State Realty and Terminal Company. From 1932 through 1960, the Site was owned by the New York Central Railroad Company and was used during this period as an active freight rail yard. Since 1960, the block has been owned by a series of realty companies and corporations. After the Consolidated Gas Company sold the Site, some of the former MGP buildings on the block were used for other purposes. The remainders of the old MGP buildings were razed after the railroad acquired the Site in 1932, and a railroad yard (with tracks) was built in their place. Later, the tracks were removed or covered and the block was used as a parking lot. In the mid-1950s, an automobile fueling and service station and garage were also built along West 17th Street, near present-day Route 9A. The buildings were demolished in the 1980s.

The section of the High Line that traverses the Site was recently renovated by the NYC Department of Parks and Recreation as an urban green space and includes public access to the park near the intersection of 10th Avenue and West 18th Street. This section of this NYC Park was opened to the public on June 9, 2009.

Summary of Work Performed

Investigations conducted at the Site include the following:

- Phase I Investigation, Melick, Tully and Associates (MTA), 1998
- Limited Phase II Environmental Site Investigation, MTA, 1998
- Geotechnical Investigation, MTA, 1998
- Soil Sample Summary and Results for Soil Safe Criteria, AKRF, Inc., 1999

- Soil Sample Summary and Results for Clean Earth Criteria, AKRF, Inc., 1999
- Interpretive Characterization of Analytical Results, Worldwide GeoSciences, Inc., 2000
- Environmental Assessment for 17th Street Residential Project, New York, NY, Langan, 2005
- Site Characterization Study, TRC Environmental, 2006
- Geotechnical Engineering Study, 17th Street Residential High-Line Properties Development, New York, NY, Langan, 2007
- Remedial Investigation Report, West 18th Street Former Gas Works, Tax Block 689, Lot 17, Manhattan, NY, ARCADIS BBL, May 2007
- Site Wide Remedial Investigation Report, West 18th Street Former Gas Works, Manhattan, New York, ARCADIS BBL, December 2009 (2009 Site-Wide RI Report)
- West 18th Street Former Gas Works, NAPL Pilot Study Report, Arcadis of New York, May 25, 2010

More than 225 borings were completed, in addition to groundwater and soil gas investigations, during previous studies. The 2007 RI Report included descriptions of each of the earlier investigations and their associated results. A Remedial Investigation Addendum (Langan, May 2011) (2011 RI Addendum) summarized the 2007 RI Report and the 2009 Site Wide RI Report.

Summary of Findings of Remedial Investigations

General Findings

A key finding of the various studies was the extensive presence of obstructions below grade throughout the Site, including foundation walls and timber piles. In addition, obstructions that appeared to be historic pier, bulkhead structures, or cribbing were also present on the western third of the Site. The shoreline in this area changed often as a result of land reclamation projects and subsequent dredging. By 1852, the original shoreline along 10th Avenue extended west, creating two additional blocks to 13th Avenue. By the early 1900's, dredging pulled the shoreline east, cutting through the Site as the current day 11th Avenue/9A highway. Similar obstructions by bulkhead walls were encountered during excavation of neighboring projects to the north. Accordingly, the presence of below grade obstructions was considered in evaluating the potential remedial alternatives.

Subsurface Quality

Dense Non-aqueous Phase Liquid (DNAPL) coal tar was observed in several borings and accumulated in on-site monitoring and recovery wells. DNAPL was observed at depths up to

35 feet below sidewalk grade, terminating at a low-permeable silty-clay confining layer. The thickest accumulation of DNAPL occurred at an irregular depression in the confining layer at the western end of the Site. Constituents of concern, benzene, toluene, ethyl benzene, and total xylenes (BTEX) and poly cyclic aromatic hydrocarbons (PAH), commonly found in coal tar, were detected in soil and groundwater at concentrations that exceed their respective guidance standards.

Volatile organic compounds (VOC) were typically not detected at concentrations above their respective NYSDEC Restricted-Residential Use Soil Cleanup Objectives (SCO) in the near-surface soil (less than 4 feet below grade). Samples collected from the shallow fill contained VOCs and semivolatile organic compounds (SVOC) at concentrations that are typical of NYC historic fill. BTEX and SVOC concentrations were typically highest in soil samples collected below the water table, where MGP-related impacts were observed.

BTEX and several SVOCs were detected in groundwater (screened within the historic fill) at concentrations that exceed NYSDEC Class GA Ambient Water Quality Standards and Guidance Values (SGV). Groundwater samples collected from wells screened below the confining layer and the shallow historic fill layer contained concentrations of BTEX and chlorinated VOCs. Chlorinated VOCs are not typically associated with MGP sites; they are likely migrating from off-site sources. SVOCs generally were not detected in wells screened below the confining layer.

According to results of the soil gas investigation, most of the compounds detected in the nine site-wide soil vapor samples were also present in ambient air. Concentrations of VOCs in soil vapor were below NYS Department of Health Air Guideline Values.

A more detailed summary of the investigation findings is provided in Section 1.6 of the Remedial Action Work Plan.

Summary of the Remedial Action

Remediation was completed between October 2013 and July 2014 under NYSDEC oversight in the BCP. The remedy generally consisted of:

- For areas east of the High Line - excavation to about 3 feet below grade and disposal of about 2,735 tons of solid waste. For areas west of the High Line – excavation to about 7 feet below grade and disposal of about 30,194 tons of solid waste;
- Installation of a subsurface containment wall in the western third of the Site;

- In situ soil solidification/stabilization (ISS);
- Installation of a highly-visible demarcation barrer at the base of all excavation areas and on top of the ISS monolith;
- Placement of of a clean backfill cover incompliance with 6 NYCRR Part 375 SCOs for Restricted –Residential and Protection of Groundwater; and
- DNAPL recovery where ISS was not feasible.

Additional details about the remedy are provided in the 2014 SMP and Final Engineering Report, and in Section 3.1 of the Excavation and Engineering Controls Protection and Restoration Plan (EECPRP).

1.3 Objectives

The purpose of this site-specific CHASP is to establish personnel protection standards and mandatory safety practices and procedures for potential encounters with nonhazardous soil or groundwater during construction and to inform employees of the potential hazards that may be encountered during work activities pursuant to the OSHA Hazard Communication Standard (29 CFR 1910 and 1926), also known as the "Right-To-Know" law (Appendix A). This plan assigns responsibilities, establishes standard operating procedures, and provides for contingencies that may arise while operations are being conducted during construction.

Langan's primary responsibility is to implement the EECRPR approved by the NYSDEC and NYCOER. Activities completed under the EECPRP will include, but are not limited to: localized excavations for building foundation elements and utilities, implementation of a community air monitoring program (CAMP), and installation of a vapor barrier system, composite cover system, and subgrade mechanically ventilated garage.

1.4 Roles and Responsibilities

The following briefly describes the health and safety (H&S) designations and general responsibilities that may be employed for this phase of work. The titles have been established to accommodate the Site requirements in order to ensure the safe conduct of on-site work. The number and type of H&S personnel for a given work location is to be based upon the particular H&S requirements relative to the proposed Site activities or operations.

1.4.1 Project Manager

The project manager (PM) has overall responsibility to ensure that personnel working on Site are safe. The specific responsibilities of the project manager include:

- Ensuring that the site-specific CHASP is developed prior to the field work or Site visit;
- Reviewing and approving the site-specific CHASP prior to the field work or Site visit;
- Ensuring employee understanding of and compliance with the site-specific CHASP; and
- Ensuring that project tasks are performed in a manner consistent with Langan's comprehensive *Health and Safety Program for Hazardous Waste Operations* and the site-specific CHASP.

1.4.2 Corporate Health and Safety Manager

The corporate health and safety manager (HSM) provides guidance to the project manager and health and safety officer (HSO) on site-specific CHASP preparation and reviews and approves the site-specific CHASP. The specific responsibilities of the corporate health and safety manager include:

- Serving as a resource in the development and implementation of site-specific CHASPs;
- Providing guidance and serving as a resource to the Langan HSO;
- Assisting the HSO with development of the site-specific CHASP, updating site-specific CHASP as dictated by changing conditions, jobsite inspection results, etc.;
- Assisting the HSO to conduct jobsite safety inspections and assisting with the correction of shortcomings found;
- Ensuring training requirements are satisfied in a timely manner;
- Ensuring medical evaluations of Langan personnel are current; and
- Maintaining records on personnel (medical evaluation results, training and certifications, accident investigation results, etc.).

1.4.3 Health and Safety Officer

The health and safety officer (HSO) is responsible and authorized to implement this site-specific CHASP and verify compliance. The HSO reports to the PM and is on-site or readily accessible to the site during all work operations. The HSO is responsible for assessing site conditions and

direction and controlling emergency response activities. The specific responsibilities of the HSO include the following:

- Participating in the development and implementation of this site-specific CHASP;
- Conducting jobsite safety inspections and correcting any shortcomings in a timely manner;
- Helping to select proper PPE (Personal Protective Equipment) and periodically inspecting it;
- Ensuring that PPE is properly stored and maintained;
- Controlling entry into and exit from the contaminated areas or zones of the Site;
- Monitoring the work parties for signs of stress, such as heat stress, fatigue, and cold exposure;
- Monitoring site hazards and conditions;
- Authorizing stop-work when site conditions result in odor or dust concentrations above action levels;
- 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; and
- Resolving conflicting situations which may arise concerning safety requirements and working conditions.

1.4.4 Key Personnel and Contact Information

Title	Name	Affiliation	Work Telephone	Cell Phone
Project Manager	Gerald Nicholls	Langan	212-479-5559	609-933-5330
HSO	Albert Tashji	Langan	212-479-5508	551-404-5597
HSM	Tony Moffa	Langan	212-491-6545	212-756-2523
N/A	Incident/Injury Hotline	Langan	201-398-4699	N/A
Client Contact	Raymond Totillo	76 Eleventh Avenue Property Owner	212-297-9888	N/A

1.4.5 Subcontractor Responsibilities

Each subcontractor shall develop and implement their own site-specific CHASP, which identifies a lead individual responsible for H&S compliance for each of their employees, lower-tier subcontractors, and consultants. The subcontractor's site-specific CHASP will meet the requirements of, at a minimum, this site-specific CHASP. The subcontractor must be familiar with and abide by the requirements outlined in their own site-specific CHASP. A subcontractor may elect to adopt Langan's site-specific CHASP as its own provided that it has given written notification to Langan, but where Langan's site-specific CHASP excludes provisions pertinent to the subcontractor's work (i.e., confined space entry), the subcontractor must provide written addendums to this site-specific CHASP. Additionally, the subcontractor must:

- Ensure their employees are trained in the use of all appropriate PPE for the tasks involved;
- Notify Langan of any hazardous material brought onto the jobsite, the hazards associated with the material, and must provide a –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 have received current training in the appropriate levels of 29 CFR 1910.120, Hazardous Waste Operations and Emergency Response (HAZWOPER);
- Ensure their employees have been medically cleared to work in Hazardous Waste Sites and to wear a respirator, if necessary;
- Ensure their employees have been fit-tested within the year on the type respirator they will wear;
- Ensure that its employees have been briefed on this site-specific CHASP and have signed the site-specific CHASP Compliance Agreement.

2.0 EMERGENCY RESPONSE PLAN

The following section discusses emergency recognition and prevention and emergency response and notification. Emergency situations include, but are not limited to, injury or chemical exposure to personnel, fire or explosion, environmental release, or serious weather conditions.

2.1 Emergency Prevention, Recognition, Response and Notification

It is the responsibility of all personnel to monitor work at the Site for potential safety hazards. All personnel are required to immediately report any unsafe conditions to the HSO. The HSO is responsible to immediately take steps to remedy any unsafe conditions observed at the Site.

If an emergency at the Site warrants evacuation, all personnel shall immediately evacuate the affected area, report to the predetermined emergency assembly location, and then report the emergency to the HSO. The predetermined emergency assembly location will be at the **southwest corner of 18th Street and 10th Avenue**. The predetermined emergency assembly location is illustrated on Figure 2.

In case of injury, field personnel should take precautions to protect the victim from further harm, immediately administer emergency first aid (as necessary), and notify local or facility emergency services and the HSM immediately. Emergency medical care will be provided by the FDNY/NYPD.

All work-related incidents, injuries of any personnel (e.g., Langan employees, subcontractors, property owners, visitors, etc.) associated with field activities, and near-misses and all property damage and injuries must immediately be report to the Langan Incident/Injury Hotline. The affected employee and the HSO must complete and submit the Employee Exposure/Injury Incident Report (Appendix B) as soon as possible following the incident.

In all situations when an on-site emergency results in an evacuation, Langan personnel shall not re-enter until:

- The conditions resulting in the emergency have been corrected;
- The hazards have been reassessed;
- This site-specific CHASP has been reviewed and revised, as necessary; and
- Langan field personnel have been briefed on changes to this site-specific CHASP.

2.2 Hospital Route Map

In case of emergency, the nearest hospital to the Site is the Beth Israel Medical Center at 1st and 16th Street, New York, New York. A route map to the hospital is provided as Figure 3. Travel time from the Site to Beth Israel Medical Center is about 14 minutes.

Directions to Beth Israel Medical Center

START: 76 Eleventh Avenue, New York, NY

1. Head northeast on 10th Avenue toward West 18th Street
2. Take the 1st Right onto West 18th Street
3. Turn Right at the 3rd cross street onto 7th Avenue
4. Turn Left onto West 14th Street
5. Turn Left onto 1st Avenue

END: 1st Avenue and 16th Street, New York, New York 10003

2.3 Emergency Contact Information

Local Resource	Name	Telephone
Fire	NYC Fire Department	911
Police	NYC Police Department	911
Ambulance	NYC Fire/Police Departments	911
Hospital	Beth Israel Medical Center	212-420-2000
Poison Control Center	N/A	1-800-222-1222
National Response Center - Pollution Toxic Chemical Oil Spills	N/A	1-800-424-8802

Local Resource	Name	Telephone
Chemical Transportation Emergency Center		800-424-9300
Center for Disease Control (CDC)		404-639-3534
EPA (RCRA Superfund Hotline)		800-424-9346
TSCA Hotline		202-554-1404
Langan Incident / Injury Hotline		201-398-4699

3.0 SCOPE OF WORK

The remedy will be completed by performing the following actions:

1. Completion of a Waste Characterization Study prior to excavation activities;
2. Excavation and removal of excess soil/fill required for development and management of such materials;
3. Transport and off-site disposal of soil/fill at licensed or permitted facilities;
4. If required, import of materials to be used for backfill and cover;
5. Construction of an engineered composite cover;
6. Installation of a vapor barrier system;
7. Construction and operation of cellar-level parking garage with mechanical ventilation; and
8. Continued DNAPL recovery in accordance with the 2014 SMP.

3.1 Task Descriptions

3.1.1 Composite Cover System

Exposure to residual soil/fill will be prevented by an engineered, composite cover system, consisting of a 12- to 14-inch thick concrete slab for on-grade foundation construction areas, and a 16- to 22-inch thick concrete pressure slab for below grade foundation construction.

Migration of soil vapor from on-site or off-site sources into the building will be mitigated with a combination of the building concrete foundation slab and waterproofing/vapor barrier membrane. The waterproofing/vapor barrier membrane will be installed as a continuous layer across the building footprint and along vertical subsurface walls.

If required, import of soils onto the property for inclusion with composite cover system will be performed in conformance with the Soil/Materials Management Plan in Appendix B of the EECPRP, and will meet the lower of 6 NYCRR Part 375 Restricted Use Restricted-Residential and Protection of Groundwater SCOs.

3.1.2 Excess Fill and Soil Removal

Removal of the 6-inch stone layer and 2- to 4-foot imported clean fill, placed during the 2014 remediation, will be required in the west part of the Site to accommodate the building's foundation, with localized excavations (up to 10 feet below grade; ± el. -11 NAVD88) for elevator pits, mat foundation pile caps. In addition to soil/fill, a portion of the ISS will be

removed, which will be in accordance with the NYSDEC-approved SMP and construction specifications. The area beneath and east of the High Line will require a "bathtub" excavation to about 17 feet below grade (± el. -8, with localized deeper excavations (up to 21 feet below grade; ± el. -12 feet NAVD88) for elevator pits and foundation pile caps.

3.1.3 Subgrade ventilated Garage

Migration of potential soil vapor into the building will be mitigated by a combination of the vapor barrier system and the ventilated parking garage. The parking garage will exchange air at a rate compliant with NYC Building Code.

3.1.4 DNAPL Recovery

DNAPL recovery continues from four on-site recovery wells. Prior to extraction, each well is gauged for product thickness and then receives a steel bailer. The bailers remain undisturbed for about a two-week period to allow DNAPL to collect. The bailers are then pulled and the volume of DNAPL measured. After extraction, each bailer is cleaned and stored in polyethylene sheeting until the next monthly event. DNAPL recovery will continue until termination is approved by the NYSDEC.

4.0 HAZARD EVALUATION

This section provides an assessment of the general hazards that may be encountered during field work activities through a task-by-task risk analysis. Potential hazards as chemical exposure and physical hazards are presented below.

4.1 Chemical Hazard Evaluation

Potentially hazardous constituents known to at the Site are volatile organic compounds (VOCs), semivolatile organic compounds (SVOCs), and metals. Exposure to chemical hazards is possible during all proposed tasks. Potential contaminants that may be encountered in the soil while conducting intrusive activities at the Site include BTEX compounds: Benzene, Toluene, Ethyl Benzene, and Xylenes, as well as isopropylbenzene, trichloroethylene (TCE) and cis-dichloroethene (DCE). Polycyclic Aromatic Hydrocarbons (PAHs) and MGP related inorganic compounds, including cyanide are present in soil.

Soil will be wetted during the remediation and development activities as needed to prevent emissions of fugitive dust. The air will be monitored for particulates and a photoionization detector (PID) will be used to monitor for VOCs.

4.2 Summary of Potential Chemical Hazards

The following table (Table 1) lists the potentially hazardous constituents that are known or may exist at the Site. The table also lists the chemical properties and OSHA permissible exposure limit (PEL), short-term exposure limit (STEL), and immediately dangerous to life and health (IDLH) level.

More information about the potentially hazardous constituents at the site, including acute toxicological symptoms and first aid procedures, can be found on their Safety Data Sheets (SDS) in Appendix C. The SDS in Appendix C are listed in alphabetical order.

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Volatile Organic Compounds						
1,2,4-Trimethylbenzene	Soil/Groundwater	None	ND	inhalation, ingestion, skin and/or eye contact	irritation 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
Benzene	Soil/Groundwater	3.19 mg/m3	1,595 mg/mg3	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation 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
Toluene	Soil/Groundwater	200 ppm	500 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation 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
Isopropylbenzene	Soil/Groundwater	50 ppm	900 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; dermatitis; headache, narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Ethyl benzene	Soil/Groundwater	435 mg/m^3	3,472 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation eyes, skin, mucous membrane; headache; dermatitis; narcosis, coma	Eye: Irrigate immediately Skin: Water flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
n-Butylbenzene	Soil/Groundwater	10 ppm	100 ppm	inhalation, ingestion, skin and/or eye contact	irritation 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
Naphthalene	Soil/Groundwater	50 mg/m^3	250 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation 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
Xylenes	Soil/Groundwater	100 ppm	900 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation 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
Tetrachloroethene (PCE)	Soil/Groundwater	100 ppm	150 ppm	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin, nose, throat, respiratory system; nausea; flush face, neck; dizziness, incoordination; headache, drowsiness; skin erythema (skin redness)	Eye: Irrigate immediately Skin: Soap flush immediately Breathing: Respiratory support Swallow: Medical attention immediately

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Trichloroethene (TCE)	Soil/Groundwater	100 ppm	1,000 ppm	Inhalation, skin or eye contact, Ingestion	nausea, vomiting, stomach pain, difficulty breathing, irritation (headache, drowsiness, dizziness, disorientation, loss of coordination, visual disturbances, bluish skin color), unconsciousness, coma	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
Vinyl Chloride	Soil/Groundwater	1 ppm	NA	Inhalation, skin or eye contact, Ingestion	Weakness, dizziness, drowsiness; headache, abdominal pain, fibrosis, cirrhosis; spleen enlargement; pallor or cyanosis of extremities; eye redness, pain;	Eye: Irrigate immediately Skin: Soap wash immediately Breathing: Respiratory support Swallow: Medical attention immediately
Semivolatile Organic Compounds						
Benzo(a)anthracene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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
Benzo(a)pyrene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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
Benzo(b)fluoranthene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Benzo(k)fluoranthene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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
Chrysene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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
Dibenzo(a,h)anthracene	Soil/Groundwater	NA	NA	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
Indeno(1,2,3-cd)pyrene	Soil/Groundwater	0.2 mg/m^3	80 mg/m^3	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
Metals						
Arsenic	Soil/Groundwater	0.5 mg/m^3	NA	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
Cadmium	Soil/Groundwater	0.005 mg/m^3	9 mg/m^3	inhalation, ingestion, skin and/or eye contact	pulmonary edema, dyspnea, cough, chest tightness, substernal pain; headache; chills, muscle aches; nausea, vomiting, diarrhea; emphysema, proteinuria, anosmia	Eyes: Irrigate immediately Skin: Soap wash promptly. Breath: Respiratory support PID Swallow: Medical attention immediately

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Cyanide	Soil/Groundwater	5 mg/m^3	25 mg/m^3	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
Copper	Soil/Groundwater	1.0 mg/m^3	100 mg/m^3	inhalation, ingestion, skin and/or eye contact	irritation eyes, nose, metallic taste; dermatitis; anemia	Eye: Irrigate immediately Skin: Soap wash promptly Breathing: Respiratory support Swallow: Medical attention immediately
Lead (as Pb)	Soil/Groundwater	0.050 mg/m^3	100 mg/m^3	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 eyes; hypertension	Eye: Irrigate immediately Skin: Soap flush promptly Breathing: Respiratory support Swallow: Medical attention immediately
Mercury	Soil/Groundwater	0.1 mg/m3	10 mg/m3	inhalation, skin absorption, ingestion, skin and/or eye contact	irritation eyes, skin; cough, chest pain, dyspnea (breathing difficulty), bronchitis, pneumonitis; tremor, insomnia, irritability, indecision, 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

Constituent of Concern	Environmental Medium	OSHA PEL	OSHA IDLH	Route of Exposure	Symptoms	First Aid
Zinc	Soil/Groundwater	15 mg/m^3	500 mg/m^3	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

Inh = Inhalation
Abs = Skin absorption
Ing = Ingestion
Con = Skin and/or eye contact
PEL = Permissible Exposure Limit (8-hour Time Weighted Average
IDLH = Immediately Dangerous to Life and Health
LEL = Lower Explosive Limit
ppm = part per million
TLV = Threshold Limit Value

abdom = abdominal
card = cardiac
[carc] = potential occupational carcinogen
CNS = central nervous system
depres = depressant/depression
derm= dermatitis
dizz = dizziness
drow = drowsiness
tg = fatigue
gidd = giddiness
inco = incoordination
inj = injury
lass = lassitude (weakness, exhaustion)
muc memb = mucous membrane
nau = nausea
pares = paresthesia
som = somnolence (sleepiness, unnatural drowsiness)
verti = vertigo
vis dist = visual disturbance

4.3 Radiation Hazard Evaluation

No radiation hazards are known or expected at the site.

4.4 Biological Hazard Evaluation

4.4.1 Animals

Animals, such as dogs, pigeons, sea gulls, mice, and rats may be encountered during construction activities. Workers shall use discretion and avoid all contact with animals. Bites and scratches from dogs can be painful and can lead to the worker contracting the rabies virus if the dog is rabid. Contact with rat and mice droppings may lead to the worker contracting hantavirus. Inhalation of dried pigeon droppings may lead to the worker contracting psittacosis; crytococcosis and histoplasmosis are also diseases associated with exposure to dried bird droppings, but these diseases are less likely to occur in a construction-type occupational setting.

4.4.2 Insects

Insects, including bees, wasps, hornets, mosquitoes, and spiders, may be encountered during construction activities. Individuals allergic to insect bites or stings may succumb to anaphylactic shock, which is a life-threatening condition and may result in death. In addition, mosquito bites may lead to a worker contracting West Nile encephalitis or other contagious diseases known to be carried by a mosquito host. Personnel bitten or stung by an insect should notify the HSO immediately. The following is a list of preventive measures related to insect bites or stings:

- Apply insect repellent prior to work and or as often as needed throughout the work shift;
- Wear protective clothing (work boots, socks and light colored pants);
- When walking in wooded areas, to the extent possible avoid contact with bushes, tall grass, or brush; and
- Field personnel who are allergic to insects or are otherwise susceptible to insect bites and stings should notify the HSO prior to commencing work and shall be responsible for supplying allergy medication for their own use throughout the work shift.
- The HSO or FSO will instruct the project personnel in the recognition and procedures for encountering potentially hazardous insects at the site.

Lyme Disease

Lyme disease is caused by infection from a deer tick that carries *Borrelia burgdorferi*, *B. garinii*, or *B. afzelii*, all spirochaete bacteria. Lyme disease is a flu-like illness most commonly observed in patients between May and October when ticks are the most active. Symptoms of lyme disease may include a stiff neck, chills, fever, sore throat, headache, fatigue, and joint pain. Early signs of an infection may include the characteristic circular and bulls-eye-shaped skin rash (*erythema chronicum migrans*) and joint pain. Lyme disease can cause serious nerve or heart problems as well as a disabling arthritis if left untreated. If a worker feels sick or exhibits any of the symptoms identified above, he or she should notify the HSO immediately.

This site-specific CHASP recommends personnel check themselves when working and after working in areas that could harbor deer ticks and wear light-colored clothing. If a worker finds a tick on his or her body, he or she should notify the HSO immediately. The tick can be removed by pulling gently at the tick's head with tweezers. The affected area should then be disinfected with an antiseptic wipe.

4.5 Physical Hazard Evaluation

4.5.1 Drilling Hazards

Use of a drill rig will require all personnel in the vicinity of the operating rig to wear steel-toed boots, hardhats, hearing protection and safety eyewear. Langan personnel should not remain in the vicinity of operating equipment unless it is required for their work responsibilities. Additionally, the following safety requirements must be followed:

- All drill rigs and other machinery with exposed moving parts must be equipped with an operational emergency stop device. Drillers and Langan personnel must be aware of this device. This device must be tested before the job starts and periodically thereafter. The driller and helper shall not simultaneously handle augers unless there is a standby person to activate the emergency stop when necessary;
- A remote sampling device must be used to sample drill cuttings if the tools are rotating or if the tools are readily capable of rotating. Langan personnel must not reach into or near the rotating equipment. If personnel must work near any tools that could rotate, the driller must shut down the rig prior to initiating work;
- Langan personnel must secure all loose clothing when in the vicinity of drilling operations;

- Direct push rigs use tremendous force to load the steel push rods. Care must be taken to maintain a safe operating distance; and
- There is a potential with using direct push rigs powered with hydraulic oil for a rupture of a hydraulic hose or fitting. Safety glasses should always be worn when operating this equipment for this reason. Exposure of body parts to a pressurized oil, air or water stream can result in severe injury or death

4.5.2 Operation of Heavy Equipment

Heavy motorized equipment (i.e., track-mounted excavators, front loaders, and support vehicles) are expected to be in use at the Site. Working around heavy motorized equipment will be a major physical hazard during construction and will require workers to be vigilant of their surroundings. Injuries may result from equipment hitting, running over, or overturning on personnel and equipment kicking up potentially harmful objects (i.e. rock, concrete, scrap metal, etc.). Occupational Safety and Health Administration (OSHA) guidelines will be followed for operating heavy equipment as outlined in 29 CFR 1926.600-602. To help prevent injuries/accidents, the following precautions will be implemented:

- Brakes, hydraulic lines, light signals, fire extinguishers, fluid levels, steering, tires, horn, and other safety devices will be checked at the beginning of each shift.
- Large construction motor vehicles will not be backed up unless the vehicle has a reverse signal alarm audible above the surrounding noise level or the vehicle is backed up only when an observer signals that it is safe to do so.
- Heavy equipment or motor vehicle cable will be kept free of all nonessential items, and all loose items will be secured.
- Large construction motor vehicles and heavy equipment will be provided with necessary safety equipment (such as seat belts, roll-over protection, emergency shut-off in case of roll-over, backup warning lights and audible alarms).
- Blades and buckets will be lowered to the ground and parking brakes will be set before shutting off any heavy equipment or vehicles.

4.5.3 Utilities

New York law requires that a utility mark out be performed at a site at least 72 hours prior to starting any subsurface work. The foundation Contractor will be responsible for contacting New York One Call (1-800-272-4480) to request a mark out of underground utilities in the proposed development area. Public utilities typically do not mark out utility lines that are

located on private property. A geophysical survey should be completed to identify the location of any private utilities at the Site. All utility mark outs will be completed by the foundation Contractor.

4.5.4 Work in Extreme Temperatures

Work under extremely hot or cold weather conditions requires special protocols to minimize the chance that employees will be affected by heat or cold stress. OSHA guidelines will be followed regarding work in excessive hot or cold temperatures.

4.5.5 Noise

The use of excavation and drilling equipment may generate noise levels that will require the use of hearing protection in the immediate vicinity. Hearing protection will be used around drilling equipment. Appropriate earplugs or earmuffs with a NRR greater than 25 will be worn to prevent overexposure.

4.5.6 Miscellaneous

Applicable OSHA 29 CFR 1910.120(m) standards for illumination shall apply. Work should be conducted during daylight hours whenever possible.

Electrical power should be provided through a ground fault circuit interrupter. Equipment that will enter an excavation must be suitable and approved (i.e. intrinsically safe) for use in potentially explosive environments. Applicable OSHA 29 CFR 1926 Subpart K standards for use of electricity shall apply.

Work where there is a fall hazard should be performed using appropriate ladders and/or protection (e.g. body harness and lifeline). All work should be conducted at the ground surface.

In accordance with 29 CFR 1910.151(c), workers involved in operations where there is the risk of eye injury, (chemical splash, etc.), should have ready access to an approved eye wash unit. Protective eye wear shall be donned in Level D. The full-face APR required by Level C and the pressure demand self-contained breathing apparatus mask required by Level B provide eye protection.

Operations where there is a potential for fire should be conducted in a manner that minimizes risk. Non-sparking tools and fire extinguishers shall be used or available as directed by the site safety officer when work is in potentially explosive atmospheres. Ignition sources shall be

removed from work areas. Explosion-proof instruments and/or bonding and grounding should be used to prevent fire or explosion when the site safety officer directs their use.

Overhead utilities should be identified and/or inspected by the Contractor and appropriate safety precautions taken before conducting operations where there is potential for contact or interference.

4.6 Summary of Potential Physical Hazards

The following table (Table 2) presents a summary of possible physical hazardous that are likely to be encountered during completion of field task. Fact sheets for cold and heat stress are included as Appendix D.

Table 2: Potential Physical Hazards Summary

Task	Possible Hazard	Description	Safety/Control Procedures
#1, #2, #3, #4	Heavy equipment	Drill rig and support vehicle	Stay back from operating equipment; wear safety vests and hard hats, coordinate and maintain eye contact with equipment operator.
#2, #3, #4	Noise	Drill rig engine, probe, auger.	Wear hearing protection.
#2, #3, #4	Falling objects	Tools and other equipment falling off drill rig.	Wear hard hat.
#1, #2, #3, #4	Underground/overhead utilities	Drill rig probe or auger or subsurface probing tool makes contact with underground object; boom touches overhead power line.	Follow mark-out policy and safe drilling practices.
#1, #2, #3, #4	Biological	Bee stings; dog, tick, snake bites; poison ivy; mosquitoes.	Wear proper PPE; be vigilant; follow safe work practices; wear insect repellant.
#2, #3, #4	Improper material handling	Improper lifting/carrying of equipment and materials causing strains.	Follow safe lifting and general material handling techniques.
#1, #2, #3, #4	Slips, trips, and falls	Various injuries could occur from slips, trips, and falls in carrying out field activities.	Good housekeeping, constant awareness and focus on the task.

Table 2: Potential Physical Hazards Summary			
Task	**Possible Hazard**	**Description**	**Safety/Control Procedures**
#1, #2, #3, #4	Vehicular traffic	Various injuries or incidents could result from vehicular traffic.	Wear high visibility safety vests; use cones to designate work area; follow safe work practices.
#1, #2, #3, #4	Sunburn	Exposure to ultraviolet solar radiation.	Wear broad spectrum sunscreen.
#1, #2, #3, #4	Adverse weather	Severe thunderstorms with strong winds and lightning; heavy precipitation (rain).	Seek shelter; work in adverse weather conditions only with proper training and equipment. In the event of heavy precipitation (rain) conditions will be assessed to determine if the work can proceed safely. If it is determined that the weather poses a significant hazard, site operations will be stopped and rescheduled.
#1, #2, #3, #4	Heat stress	Heat exhaustion, heat stroke, dehydration.	Proper and consistent hydration; seek shade during work breaks; wear light-colored and breathable clothing; in cases of heat stroke call for emergency help.
#1, #2, #3, #4	Cold stress	Frostbite, hypothermia.	Proper and consistent hydration; wear warm clothing in cold weather; seek warmth during work breaks; in cases of hypothermia call for emergency help

5.0 PERSONAL PROTECTIVE EQUIPMENT

PPE must protect workers from the specific hazards they are likely to encounter on-site. Selection of the appropriate PPE must be taken 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, engineering controls and the proposed work tasks to be performed at the site, Level D Protection should be used. The decision to modify standard PPE will be made by the site. The general levels of protection are described below.

Level D

- Safety glasses with side-shields or chemical splash goggles if a splash hazard is present;
- Safety boots/shoes (toe-protected);
- Hard hat;
- Long sleeve work shirt and work pants;
- Nitrile gloves;
- Hearing protection (as needed);
- Traffic vest (if working or adjacent to roadway);
- Coveralls (Tyvek or equivalent) if extensive splashing or contaminated media is expected.

Level C

- Full or half mask respirator, air-purifying, cartridge-equipped, NIOSH approved respirator suitable for the compound of concern
- Inner (latex) and outer (nitrile) chemical resistant gloves;
- Chemical-resistant safety boots/shoes (toe-protected);
- Hard hat;
- Long sleeve work shirt and work pants;
- Coveralls (Tyvek or equivalent);
- Hearing protection (as needed);

- Traffic vest (if working on or adjacent to roadway).

5.1 OSHA PPE Requirements

All personal protective equipment used during construction must meet the following OSHA standards:

Type of Protection	Regulation	Source
Eye and Face	29 CFR 1910.133 29 CFR 1926.102	ANSI Z87.1-1968
Respiratory	29 CFR 1910.134 29 CFR 1926.103	ANSI Z88.1-1980
Head	29 CFR 1910.135 29 CFR 1926.100	ANSI Z89.1-1969
Foot	29 CFR 1910.136 29 CFR 1926.96	ANSI Z41.1-1967
Notes: 1. ANSI – American National Standards Institute		

Both the respirator and cartridges specified for use in Level C protection must be fit-tested prior to use in accordance with OSHA regulations (29 CFR 1910.1025; 29 CFR 1910.134). Based on performance criteria of air purifying respirators, they cannot be worn under the following conditions:

- Oxygen deficiency;
- Immediately Dangerous to Life or Health (IDLH) concentrations;
- High relative humidity; and
- If contaminant levels exceed designated use concentrations.

6.0 AIR MONITORING

6.1 General

Atmospheric conditions during field activities at the breathing zone for site workers and at the Site perimeter will be monitored to identify potentially hazardous environments and determine reference or background concentrations.

Breathing zone air monitoring will be used to define work zones and determine the appropriate level of PPE to be worn by Langan field personnel. Upgrades/downgrades to PPE will be made

based on air monitoring results in the breathing zone. In general, work shall be initiated in Level D PPE with a contingency to upgrade the level of PPE if action levels are exceeded.

Site perimeter air monitoring, or the Community Air Monitoring Plan (CAMP) requires continuous, real-time air monitoring for VOCs and particulate matter at the perimeter of the construction area during ground intrusive activities. Ground intrusive activities include, but are not limited to, drilling and excavating, handling, stockpiling, and loading of soil and fill material.

6.2 Breathing Zone Air Monitoring

6.2.1 Instrumentation

Langan field personnel will be equipped with a RAE Systems MiniRAE 2000 or 3000 with a 10.6eV lamp (photoionization detector) to monitor levels of total VOCs. The PID will be calibrated before each use and the calibration readings will be recorded in the field log book. The PID must be calibrated daily in accordance with the manufacturer's specifications. The PID calibration typically requires the use of a span gas (e.g., 100 ppm isobutylene) and zero gas (e.g., fresh air). Be sure that all the required calibration equipment and supplies are provided with the PID (e.g., span gas cylinder, regulator, tubing, and Tedlar™ bag).

6.2.2 Action levels

Action levels for VOCs in the breathing zone are presented in Table 3 below.

Table 3: Breathing Zone Air Monitoring - Action Levels for VOCs

Reading	Action Required
Background to < 1 ppm[(1)]	No respirator required; no further action required.
> 1 ppm, < 5 ppm for > 5 minutes	Temporarily discontinue all activities and evaluate potential causes of the excessive readings. If these levels persist and cannot be mitigated (i.e., via dust suppression, etc.), contact HSO to review conditions and determine source and appropriate response action. If PID readings remain above 5 ppm, temporarily discontinue work and upgrade to Level C protection. If sustained PID readings fall below 1 ppm, downgrading to Level D protection may be permitted.

> 5 ppm, < 100 ppm(2) for > 5 minutes	Discontinue all work; all workers shall move to an area upwind of the job site. Evaluate potential causes of the excessive readings and allow work area to vent until VOC concentrations fall below 5 ppm. Level C protection will continue to be used until PID readings fall below 1 ppm.
> 150 ppm for > 5 minutes	Evacuate work area.
Notes: (1) 1 ppm is based on OSHA PEL for benzene. (2) 100 ppm is based on 1% being the OSHA PEL for benzene (1 ppm). (3) 500 ppm is NIOSH IDLH for benzene.	

6.3 Community Air Monitoring Plan

6.3.1 Instrumentation

Langan field personnel will be equipped with photoionization detectors (PID) (RAE Systems MultiRAE 2000 or 3000 with a 10.6eV lamp) to monitor for total VOCs and real-time Dust Trak aerosol meters to monitor levels of particulate matter (i.e., fugitive dust and aerosols). Instruments will be calibrated before each use; calibration readings will be recorded in the field log book. The PID and Dust Traks must be calibrated daily in accordance with the manufacturer's specifications. The PID calibration typically requires the use of a span gas (e.g., 100 ppm isobutylene) and zero gas (e.g., fresh air). Be sure that all the required calibration equipment and supplies are provided with the PID (e.g., span gas cylinder, regulator, tubing, and Tedlar™ bag).

6.3.2 Action Levels

VOC Monitoring, Action Levels, Responses

Concentrations of VOCs will be monitored at the upwind and downwind site perimeter on a continuous basis during soil disturbance activities. Upwind concentrations will be used to establish background conditions. The monitoring work will be performed using equipment appropriate to measure the types of contaminants known or suspected to be present. The equipment will be calibrated daily. The equipment will be equipped with an audible alarm to indicate if action levels are exceeded. The equipment will be programmed to record 15-minute average concentrations, which will be compared to the levels specified below:

- If the ambient air concentration of total organic vapors at the downwind perimeter of the work area exceeds 5 parts per million (ppm) above background for the 15-minute average, work activities will be temporarily halted and monitoring continued. If the total organic vapor level readily decreases (per instantaneous readings) below 5 ppm over background, work activities will resume with continued monitoring.
- If total organic vapor levels at the downwind perimeter persist at levels in excess of 5 ppm over 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 work area 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 over background for the 15-minute average.
- If the organic vapor level is above 25 ppm at the site perimeter, activities will be shutdown.

The 15-minute average readings will be recorded and presented in the daily reports. Instantaneous readings, if any, will also be recorded by Langan field staff on routine inspection of CAMP stations and used for decision-making purposes.

Particulate Monitoring, Action Levels, Responses

Concentrations of particulate matter will be monitored continuously at the upwind and downwind site perimeters during soil disturbance activities. The particulate monitoring will be performed using real-time monitoring equipment capable of measuring particulate matter less than 10 micrometers (PM10) in size. The equipment will be calibrated daily. The equipment will be equipped with an audible alarm to indicate action levels are exceeded. The equipment will be programmed to record 15-minute average concentrations, which will be compared to the levels specified below:

- If the downwind PM10 particulate level is 100 micrograms per cubic meter ($\mu g/m^3$) greater than background (upwind perimeter) for the 15-minute period or if airborne dust is observed leaving the work area, then dust suppression techniques will be employed. Work will continue with dust suppression techniques provided that downwind PM10 particulate levels do not exceed 150 $\mu g/m^3$ above the upwind concentration and provided that no visible dust is migrating from the work area.
- If, after implementation of dust suppression techniques, downwind PM10 particulate levels are greater than 150 $\mu g/m^3$ above the upwind level, work will be stopped and work activities will be reevaluated. Work will resume provided dust suppression

measures and other controls are successful in reducing the downwind PM10 particulate concentration to within 150 µg/m^3 of the upwind concentration and in preventing visible migration of dust off-site.

In addition, to continuous, real-time monitoring of particulate matter, fugitive dust migration will be visually assessed during all soil disturbance activities by Langan field staff. The 15-minute average readings will be recorded and presented in the daily reports. Instantaneous readings, if any, will also be recorded by Langan field staff on routine inspection of CAMP stations and used for decision-making purposes.

6.4 Major Vapor Emissions and Response Plan

If any organic levels greater than 5 ppm over background are identified 200 feet downwind from the site, or half the distance to the nearest residential or commercial property, whichever is less, all work activities must be halted or odor controls must be implemented.

If, following the cessation of the work activities, or as the result of an emergency, organic levels persist above 5 ppm above background 200 feet downwind or half the distance to the nearest residential or commercial property from the hot zone, the air quality must be monitored within 20 feet of the perimeter of the nearest residential or commercial structure (20-foot zone).

The Major Vapor Emission Response Plan shall be implemented if either of the following criteria is exceeded in the 20-foot zone:

- Sustained organic vapor levels approaching 5 ppm above background for a period of more than 30 minutes; or
- Organic vapor levels greater than 5 ppm above background for any time period.

If conditions warrant the activation of the Major Vapor Emission Response Plan, the following activities shall be performed:

- The HSO shall immediately contact the local police authority and inform the police of the situation;
- Air monitoring shall be conducted at 30-minute intervals within the 20-foot zone. If two successive readings below action levels are measured, air monitoring may be halted or modified by the HSO; and
- Emergency contacts will be contacted and informed (as necessary).

7.0 SITE CONTROL

7.1 Work Zones

The need to formally establish specific work zones (e.g., support zone, contamination reduction zone, and exclusion zone) during work activities will be determined by the HSO.

- The **support zone** is any area of the site that is outside of the exclusion and contamination reduction zones.
- The **contamination reduction zone** is the area between the exclusion and support zones that provides a transition between contaminated and clean areas.
- The **exclusion zone** is any area of the site where hazardous substances are present, or are reasonably suspected to be present, and pose an exposure hazard to personnel.

7.2 General Safe Work Practices

Hazards should be controlled at site areas by limiting entrance to exclusion zones to essential personnel and by implementing the following rules:

- Non-essential (as judged by the HSO) personnel and unauthorized persons shall not enter the exclusion or decontamination zone;
- Before entering the exclusion or decontamination zones, all personnel should be familiar with emergency response procedures, site safety locations, first aid and communication equipment, and the location of the map to the hospital and the list of emergency telephone numbers;
- The buddy system should be used at all times by field personnel in the exclusion zone; no one is to perform work within the exclusion zone alone. When in Level D or C, visual contact or radio contact should be maintained at all times;
- Contact with contaminated and potentially contaminated surfaces should be avoided. Walk around (not through) puddles and discolored surfaces. Do not kneel on the ground or place equipment on the ground. Protect equipment from contamination;
- No open flames in the work zone;
- Always use the appropriate level of personal protective equipment (PPE);
- 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;
- All personnel exiting the exclusion zone should exercise the decontamination procedures described in this site-specific CHASP;
- Beards or other facial hair that interferes with respirator fit will preclude admission to the exclusion zone;
- Each worker will be supplied with and maintain his/her own personal protective equipment;
- No person will eat, drink, or chew gum or tobacco in potentially contaminated areas. Single portion drink containers and drinking of replacement fluids for heat stress control will be permitted only in support areas; and
- Smoking is prohibited by Langan personnel and subcontractors in all areas of the site because of the potential for contaminating samples and for the health of the field team.

7.3 Site Safety Meetings

Langan field personnel will be given briefings by the HSO on a daily or as-needed basis to further assist personnel in conducting the work activities safely. Briefings will be provided when new activities are to be conducted, new staff enters the Site, changes in work practices are to be implemented due to new information, or if site or environmental conditions change. Briefings will also be given to facilitate conformance with prescribed safe practices when performance deficiencies are identified during routine daily activities or as a result of jobsite safety inspections. Briefings will include the following:

- Scope of work for the day;
- Review of safety information relevant to planned tasks and environmental conditions;
- New activities/tasks;
- Results of Jobsite Safety Inspection Checklist;
- Changes in work practices;
- Safe work practices; and
- Discussion and remedies for noted or observed deficiencies.

The jobsite safety inspection form is included as Appendix E. The site safety meeting form is included as Appendix F.

7.4 Site Communications

Each field team will carry a cell phone or satellite phone that is in good working order. If there is any type of emergency that requires the site to be evacuated (e.g., severe thunderstorm with lightening), the field team leader will lead the team to the predetermined emergency assembly location. All other emergency notifications that do not require evacuation will be conducted using a cell phone or satellite. Emergency phone numbers are listed above in Section 2.3.

7.5 Buddy System

The buddy system will be used at the site at all times. The buddy system is a system of organizing employees into field teams in such a manner that each employee of the field team is designated to be observed by at least one other employee in the field team. The purpose of the buddy system is to provide rapid assistance to employees in the event of an emergency.

7.6 Personnel Hygiene

The following personnel hygiene practices will be used at the site to reduce exposure to hazards:

- Long hair will be secured away from the face so it does not interfere with any work activities;
- Personnel leaving potentially contaminated areas will wash their hands, forearms and faces in the contamination reduction zone prior to entering any clean areas or eating areas.
- Personnel leaving potentially contaminated areas will shower (including washing hair) and change to clean clothing as soon as possible after leaving the site.
- No person will eat, drink, or chew gum or tobacco in potentially contaminated areas. Single portion drink containers and drinking of replacement fluids for heat stress control will be permitted only in support areas.
- Smoking is prohibited by Langan personnel and subcontractors in all areas of the site because of the potential for contaminating samples and for the health of the field team.

7.7 Decontamination

Personnel, clothing, equipment, and samples leaving contaminated areas of the site must be decontaminated. Decontamination for this operation is achieved through physical removal and chemical detoxification/disinfection/sterilization. The first step in decontamination is prevention. Detailed procedures for personnel and equipment decontamination are provided in Appendix G. The following standard operating procedures were established to minimize contact with wastes:

- Wear disposable clothing;
- Practice work habits that minimize contact with hazardous or potentially hazardous substances;
- Use disposable equipment, where appropriate.

Boots and other potentially contaminated garments that have come in contact with hazardous materials should be cleaned in wash tubs with detergent/water solution and rinsed with water and should remain on-site. Decontamination waste (e.g. solutions, etc.) resulting from the decontamination of field equipment (e.g., sampling equipment, etc.) will be collected, containerized in tightly-sealed, well-marked drums, characterized, and properly disposed of. Disposable contaminated clothing and equipment will be collected in plastic bags, containerized in tightly-sealed, well-marked drums, and properly disposed of.

7.8 Standing orders

The site safe practices (i.e., standing orders) for the project are included in Appendix H.

8.0 HEALTH AND SAFETY TRAINING AND MEDICAL SURVEILLANCE

The completion of an initial 40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER) training program (or its equivalent) as detailed in OSHA's 29 CFR 1910.120(e) is required for all employees who will perform work in areas where the potential exposure to hazardous substances exists. Annual 8-hour refresher training is also required to maintain competencies to ensure a safe work environment. In addition to these training requirements, supervisory personnel must also receive eight additional hours of specialized management training. Training records are maintained by the HSM.

The HSO shall inform Langan employees about the activities, procedures, monitoring, and equipment for site operations (including site and facility layout, chemical and physical hazards, emergency services at the site, and the provisions set forth in the site-specific CHASP).

8.1 Respirator Fit Testing Requirements

Langan personnel who may be required to perform work activities while wearing a respirator must receive medical clearance to do so consistent with 29 CFR 1910.134(e), Respiratory Protection. Medical evaluations will be performed by, or under the direction of, a physician board-certified in occupational medicine. Langan employees who have medical clearance to wear a respirator and could be potentially exposed to hazardous substances at the site shall possess a full face-piece, air-purifying respirator and have been successfully quantitative fit-tested within the past year. Results of medical evaluations and quantitative fit-test records are maintained by the HSM.

8.2 Medical Monitoring Requirements

Langan personnel who will be performing work activities involving potential exposure hazardous substances will be required to have passed an initial baseline medical examination, with annual 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.

8.3 Confined Space Entry

Entry into confined space is not anticipated. If a project area were identified as a confined space, entry into this confined space by Langan personnel is prohibited by its own policy.

9.0 HEALTH AND SAFETY PLAN APPROVAL

By their signature, the undersigned certify that this site-specific CHASP is approved.

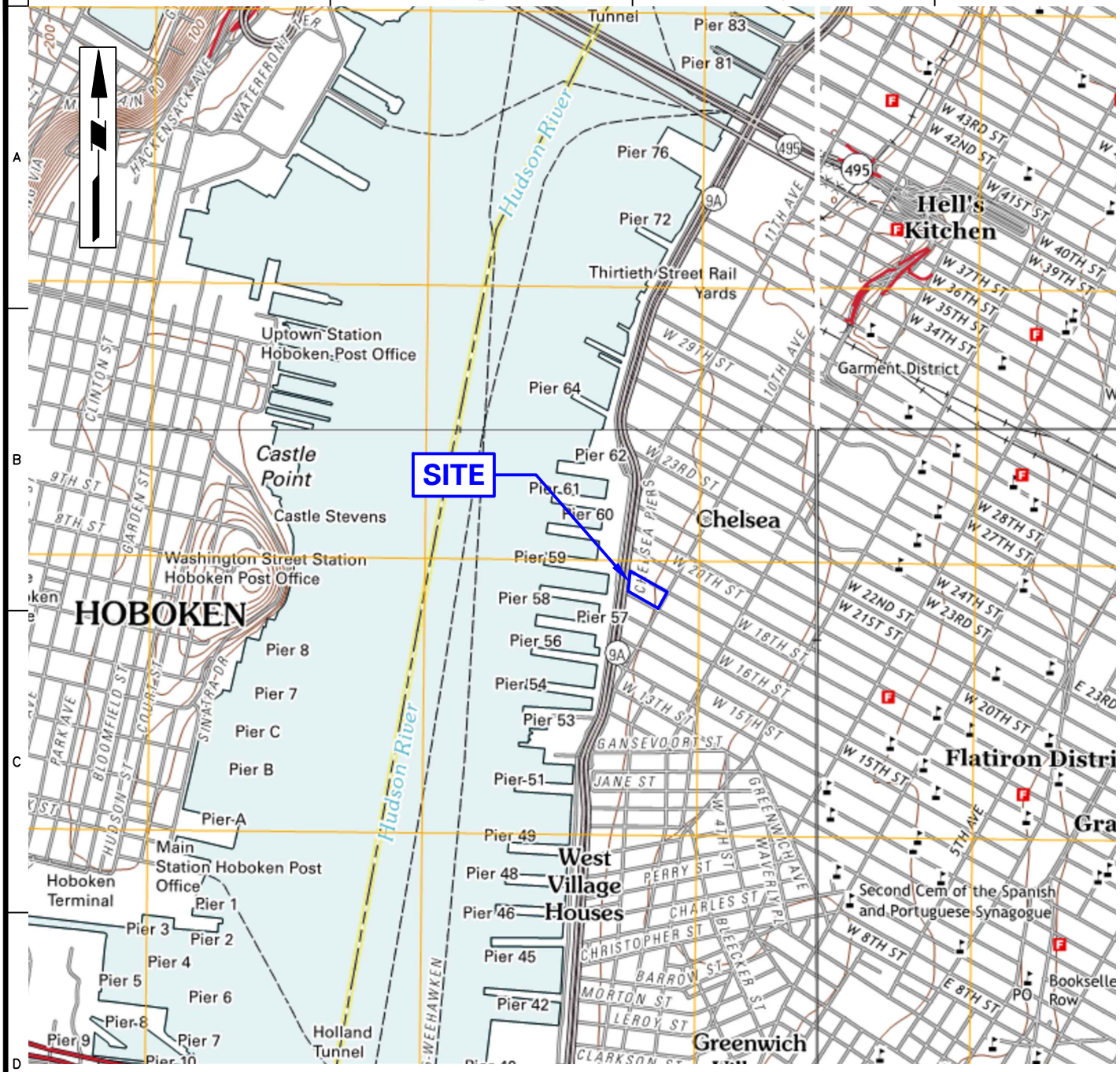
_____	_____
Gerald Nicholls, Project Manager (PM)	Date
_____	_____
Tony Moffa, CHMM, Health & Safety Manager (HSM)	Date
_____	_____
Albert Tashji, Site Health & Safety Officer (HSO)	Date

10.0 CHASP COMPLIANCE AGREEMENT

All Langan field personnel and subcontractors who enter the Site will sign this site-specific CHASP Compliance Agreement to indicate that they are familiar with this site-specific CHASP and that they understand it and agree to abide by it. A copy of this site-specific CHASP must be on-site at all times and must be maintained by the HSO.

Printed Name	Signature	Affiliation	Date

FIGURES



NOTE: BASE MAP IS TAKEN FROM USGS 7.5 MINUTE TOPOGRAPHIC MAPS FOR THE CENTRAL PARK, BROOKLYN, JERSEY CITY, AND WEEKHAWKEN QUADRANGLES.

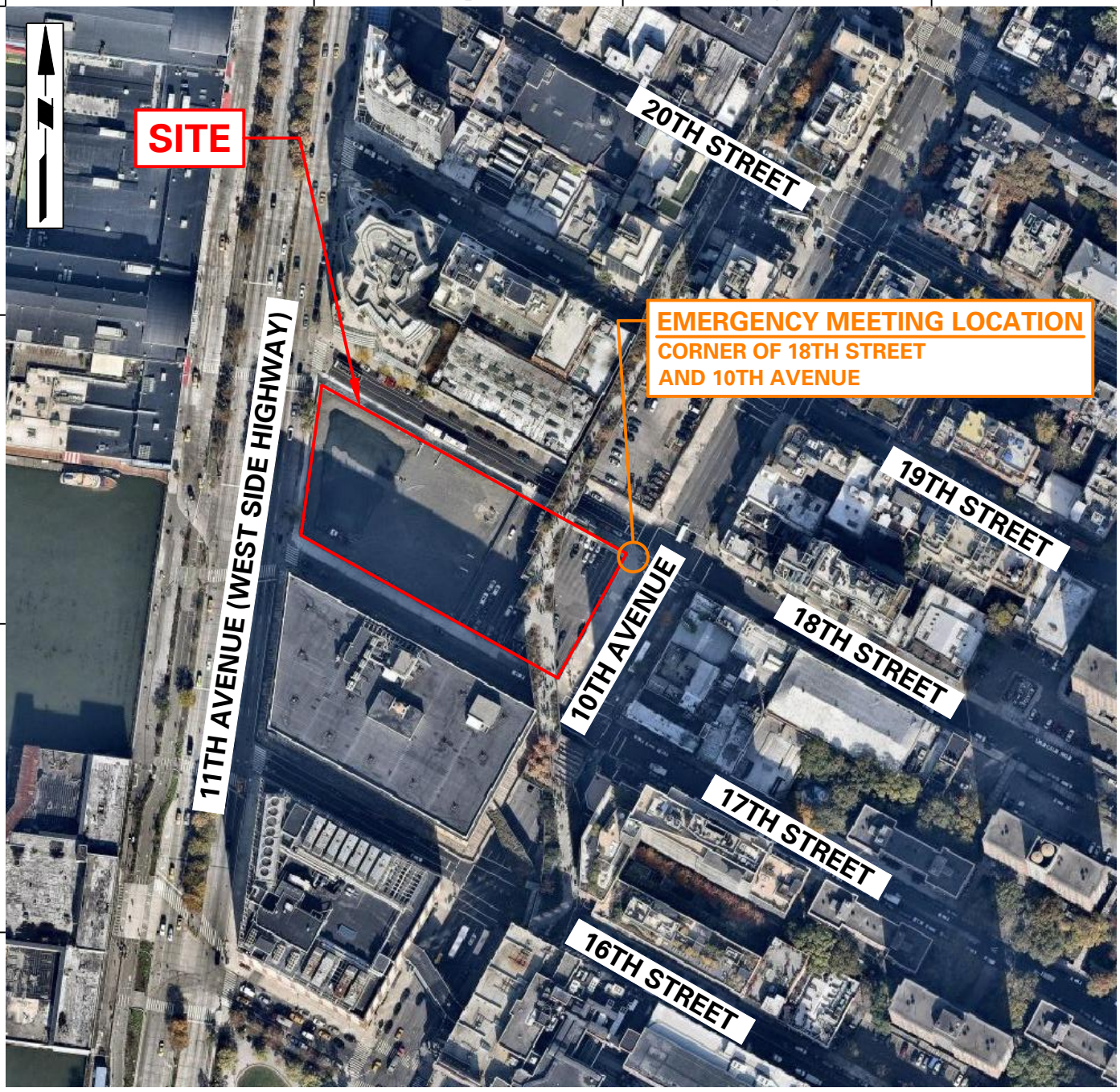
LEGEND:

APPROXIMATE SITE BOUNDARY

LANGAN
21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project	76 ELEVENTH AVENUE BLOCK No. 689, LOT No. 17 NEW YORK NEW YORK
Figure Title	SITE LOCATION MAP
Project No.	100513101
Date	2/10/2016
Scale	N.T.S.
Drawn By / Checked By	AT / GN
Submission Date	FEBRUARY 2016
Figure No.	1
Sheet	1 of 3

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\HASP\Figure 1 - Site Location Map.dwg Date: 2/12/2016 Time: 12:46 User: atashji Style Table: Langan.stb Layout: SLM



NOTE: BASE MAP IS REFERENCED FROM NEARMAP SATELLITE IMAGERY (us.nearmap.com) - CIRCA OCTOBER 2015

LEGEND:

APPROXIMATE SITE BOUNDARY

EMERGENCY MEETING LOCATION

200 0 100 200

SCALE IN FEET

LANGAN

21 Penn Plaza, 360 West 31st Street, 8th Floor
New York, NY 10001
T: 212.479.5400 F: 212.479.5444 www.langan.com

Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C. S.A.
Langan Engineering, Environmental, Surveying and Landscape Architecture, D.P.C.
Langan Engineering and Environmental Services, Inc.
Langan CT, Inc.
Langan International LLC
Collectively known as Langan

Project

76 ELEVENTH AVENUE

BLOCK No. 689, LOT No. 17

NEW YORK NEW YORK

Figure Title

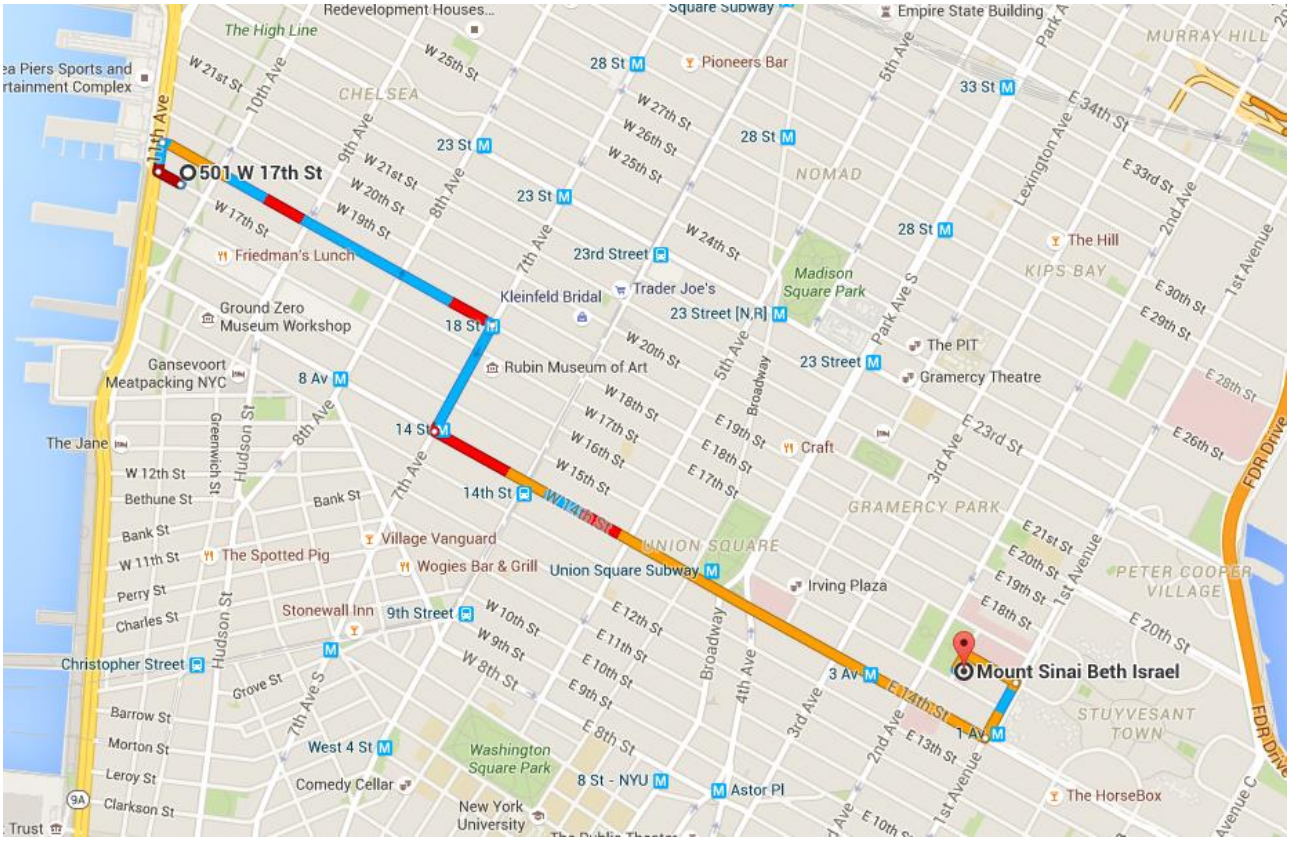
SITE LOCATION MAP (AERIAL)

Project No. 100513101	Figure No. 2
Date 2/10/2016	
Scale 1"=200'	
Drawn By AT / Checked By GN	
Submission Date FEBRUARY 2016	Sheet 2 of 3

Filename: \\Langan.com\data\EP\data1\100513101\Cadd Data - 100513101\SheetFiles\Environmental\HASP\Figure 2 - Site Location Map (Aerial).dwg Date: 2/12/2016 Time: 12:48 User: atashji Style Table: Langan.stb Layout: SLM

FIGURE 3

ROUTE MAP TO HOSPITAL (BETH ISRAEL MEDICAL CENTER)



BETH ISRAEL MEDICAL CENTER
1ST AVENUE AT 16TH STREET, NEW YORK, NY 10003
212-420-2000

APPENDIX A

OSHA RIGHT-TO-KNOW FACT SHEET

You Have a Right to a Safe and Healthful Workplace.

IT'S THE LAW!

- You have the right to notify your employer or OSHA about workplace hazards. You may ask OSHA to keep your name confidential.
- You have the right to request an OSHA inspection if you believe that there are unsafe and unhealthful conditions in your workplace. You or your representative may participate in the inspection.
- You can file a complaint with OSHA within 30 days of discrimination by your employer for making safety and health complaints or for exercising your rights under the *OSH Act.*
- You have a right to see OSHA citations issued to your employer. Your employer must post the citations at or near the place of the alleged violation.
- Your employer must correct workplace hazards by the date indicated on the citation and must certify that these hazards have been reduced or eliminated.
- You have the right to copies of your medical records or records of your exposure to toxic and harmful substances or conditions.
- Your employer must post this notice in your workplace.

The *Occupational Safety and Health Act of 1970 (OSH Act),* P.L. 91-596, assures safe and healthful working conditions for working men and women throughout the Nation. The Occupational Safety and Health Administration, in the U.S. Department of Labor, has the primary responsibility for administering the *OSH Act.* The rights listed here may vary depending on the particular circumstances. To file a complaint, report an emergency, or seek OSHA advice, assistance, or products, call 1-800-321-OSHA or your nearest OSHA office: • Atlanta (404) 562-2300 • Boston (617) 565-9860 • Chicago (312) 353-2220 • Dallas (214) 767-4731 • Denver (303) 844-1600 • Kansas City (816) 426-5861 • New York (212) 337-2378 • Philadelphia (215) 861-4900 • San Francisco (415) 975-4310 • Seattle (206) 553-5930. Teletypewriter (TTY) number is 1-877-889-5627. To file a complaint online or obtain more information on OSHA federal and state programs, visit OSHA's website at **www.osha.gov**. If your workplace is in a state operating under an OSHA-approved plan, your employer must post the required state equivalent of this poster.

1-800-321-OSHA
www.osha.gov

U.S. Department of Labor • Occupational Safety and Health Administration • OSHA 3165

APPENDIX B

EMPLOYEE EXPOSURE / INJURY INDICENT REPORT

INCIDENT REPORT

LANGAN EMPLOYEE EXPOSURE/INJURY INCIDENT REPORT
(Submit a Separate Report for Each Employee and/or Incident)

Date: _____

Employee Name:_____ Employee No:_____

Sex: M _____ F _____ Age: _____

Region: _____ Location:_____

Project: _____ Project No: _____

Incident:_____

Type: Possible Exposure _____ Exposure _____ Physical Injury _____

Location: _____

Date of Incident: _____ Time of Incident: _____

Date of Report Incident: _____

Person(s) to Whom Incident was Reported: _____

Weather Conditions During Incident: Temperature _____ Humidity _____

Wind Speed and Direction: _____ Cloud Cover: _____

Clear: _____ Precipitation: _____

Materials Potentially Encountered: _____

Chemical (give name of description - liquid, solid, gas, vapor, fume, mist):

_____

_____

Radiological:_____

Other: _____

Nature of the Exposure/Injury: (State the nature of the exposure/injury in detail and list the parts of the body affected. Attach extra sheets if necessary).

_____

_____

_____

_____

_____

Did you receive medical care? Yes _____ No _____ If so, when _____

Where? On-Site _____ Off-Site _____

By Whom: Name of Paramedic: _____

Name of Physician: _____

Other: _____

If Off-Site, name facility (hospital, clinic, etc):_____

_____

Length of stay at the facility?_____

Was the Site Safety Officer contacted? Yes _____ No _____ When?_____

Was the Corporate Health and Safety Officer contacted? Yes _____ No _____

If so, who was the contact?_____

Did the exposure/injury result in permanent disability? Yes _____ No _____

If so, explain:_____

_____

_____

_____

Has the employee returned to work? Yes _____ No _____

List the names of other persons affected during this incident:

_____

_____

_____

_____

List the names of persons who witnessed the exposure/injury incident:

_____

_____

_____

_____

_____

_____

_____

Possible cause of the exposure/injury incident: _____

_____

_____

_____

_____

_____

What was the name and title of the field team leader or immediate supervisor at the site of the incident?

_____

Was the operation being conducted under an established Health and Safety Plan?

Yes _____ No _____ If yes, attach a copy. If no, explain

_____

_____

_____

_____

Describe protective equipment and clothing used by the employee:

_____

_____

_____

_____

_____

_____

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

_____

_____

What was the employee doing when the exposure/injury occurred? (Describe briefly as Site Reconnaissance, Site Characterization, or Sampling, etc.):

_____

_____

_____

_____

_____

_____

Where exactly on site or off site did the exposure/injury occur?

_____

_____

_____

_____

_____

How did the exposure/injury occur? (Describe fully what factors led up to and/or contributed to the incident):

_____

_____

_____

_____

_____

Name of person(s) initiating report, job title, phone number:

_____

_____

_____

_____

_____ _____

Employee Signature Date

_____ _____

Site Safety Officer Signature or Field Team Leader Signature Date

APPENDIX C

SAFETY DATA SHEETS

Fisher Scientific
Part of Thermo Fisher Scientific

MATERIAL SAFETY DATA SHEET

Section 1 - Chemical Product and Company Identification

MSDS Name: 1,2,4-Trimethylbenzene

Catalog Numbers: AC140090000, AC140090010, AC140090025, 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: XN N

Risk Phrases: 10 20 36/37/38 51/53

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: 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 removing 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.

Extinguishing Media: Use water spray to cool fire-exposed containers. Use water spray, dry chemical, carbon dioxide, or chemical foam.

Autoignition Temperature: 500 deg C (932.00 deg F)

Flash Point: 48 deg C (118.40 deg F)

Explosion Limits: Lower: 0.9 vol %

Explosion Limits: Upper: 6.4 vol %

NFPA Rating: health: 2; flammability: 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: Use spark-proof tools and explosion proof equipment. Do not get in eyes, on skin, or on clothing. Do not ingest 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

Chemical Name	ACGIH	NIOSH	OSHA - Final PELs
1,2,4-Trimethylbenzene	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

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: 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

RTECS#: 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: Fish: Fathead Minnow: LC50 = 77.2 mg/L; 96 Hr; Flow-through at 25 C (pH 7.24)

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

US DOT
Shipping Name: FLAMMABLE LIQUIDS, N.O.S. (1,2,4-Trimethylbenzene)
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

Material Safety Data Sheets

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
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 Information

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

Section 11 - Toxicological Information

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

8/9/2002 10:40:46 AM

Complying with 1907/2006/EEC Regulation of 18 December 2006 ("REACH Regulation") and REGULATION (EC) No 1272/2008 (CLP)

Section 1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/ UNDERTAKING

Identification of the substance/preparation

Substance Name: BENZENE

Trade names: BENZENE

Synonyms: Benzol; Cyclohexatriene; Phenyl hydride

CAS #: 71-43-2

EC #: 200-753-7

Common/important uses of the substance/preparation: Benzene is used as an intermediate in synthesis and manufacture of organic aromatic substances. Benzene is defined as "transported isolated intermediate" (Article 3 (15) of REACH) and should be used under "Strictly Controlled Conditions" (Article 18 (4) for Intermediates under REACH.

Company/undertaking identification

Supplier/Manufacturer: GADIV PETROCHEMICAL INDUSTRIES Ltd.
P.O.B 32 HAIFA
Tel: +972-4-8788020
Fax: +972-4-8788018
E-mail: Gadiv@orl.co.il

E-mail address of person responsible for this SDS: gamiram@orl.co.il

Emergency telephone number (including hours of operation): +972-4-8788643

Section 2. HAZARDS IDENTIFICATION

According to EC Directive 2001/59/EC

Most Important Hazards

Physical / Chemical Hazards:
R11: Highly flammable.

Health Hazards:
R45: May cause cancer.
R46: May cause heritable genetic damage.
R36/38: Irritant; Irritating to eyes and skin.
R48/23/24/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with the skin and if swallowed.
R65: Harmful: may cause lung damage if swallowed.

Environmentally Hazards:
Not Classified.

Classification

F – Highly flammable
T-Toxic

GHS-Classification

Physical / Chemical Hazard Statements:
H225: Highly flammable liquid and vapour.

Health Hazard Statements:
H350: May cause cancer.
H340: May cause genetic defects.
H372: Causes damage to organs through prolonged or repeated exposure.
H304: May be fatal if swallowed and enters airways.
H319: Causes serious eye irritation.
H315: Causes skin irritation.

Signal Word

Danger

See section 11 for more detailed information on health effects and symptoms.

Section 3. COMPOSITION/INFORMATION ON INGREDIENTS

Substance/preparation

Formula: C_6H_6

Molecular weigth: 78.11 g/mol

Ingredient name	CAS number	EC number	%	EU Classification	GHS Classification
Benzene	71-43-2	200-753-7	100	F; R11 Carc. Cat. 1; R45 Muta. Cat. 2; R46 T; R48/23/24/25 Xn; R65 Xi; R36/38	Flam. Liq. 2 H225 Carc. 1A H350 Muta. 1B H340 STOT RE 1 H372 Asp. Tox. 1 H304 Eye Irrit. 2 H319 Skin Irrit. 2 H315
See section 16 for the full text of the R-phrases declared above					

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

Eyes contact: In case of contact with eyes rinse thoroughly with plenty of water and seek medical advice.

Skin contact: In case of contact with skin wash off immediately with soap and plenty of water, and seek medical advice.

Inhalation: Remove from exposure, lie down. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.

Ingestion: Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Get medical attention immediately.

Expected delayed effects: N/A

See section 11 for more detailed information on health effects and symptoms.

Section 5: FIRE-FIGHTING MEASURES

Extinguishing media

Suitable: 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. Cool all affected containers with flooding quantities of water.

Not suitable: Solid streams of water may be ineffective.

Special exposure hazards arising from the substance/preparation including combustion products and gases: Thermal decomposition can lead to release of irritating gases and vapors. Highly flammable material. Flash back possible over considerable distance. Container explosion may occur under fire conditions.

Special protective equipment for fire fighters: Fire fighters should wear full protective clothing and self-contained breathing apparatus in positive pressure mode.

Further information: Move containers from fire area if possible to do so without risk. Use water spray to cool unopened containers.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal precautions: Wear protective clothing. Avoid contact with skin eyes. Avoid breathing vapors, mist or gas. Remove all sources of ignition. Ventilate area of spill. Evacuate personnel to safe areas. Beware of vapours accumulating to form explosive concentrations. Vapours can accumulate in low areas.

Environmental precautions: Prevent entry into waterways, sewers, basements or confined areas.

Methods for cleaning up

Absorb the chemical onto sand, vermiculite, or any other non-combustible absorbent, and scoop into containers for later disposal.

Section 7: HANDLING AND STORAGE

Handling: Avoid contact with eyes, skin and clothing. Avoid inhalation of vapour or mist. Do not permit eating/drinking/smoking near the material. Keep away from heat, sparks and open flame. Take measures to prevent the build up of electrostatic charge.

Storage: Store in cool place. Keep container tightly closed in a dry and well-ventilated place. Keep away from incompatible materials.

Section 8: EXPOSURE CONTROL / PERSONAL PROTECTION

Exposure limit values:

Ingredient name	Occupational exposure limits
Benzene	TLV-ACGIH 0.5 ppm (TWA), 2.5 ppm (STEL) REL-NIOSH 0.1 ppm (TWA), 1 ppm (CEIL)* *15 Minutes

Exposure controls

Occupational exposure controls:

Use process enclosures, local exhaust ventilation, or others engineering controls to keep airborne levels below recommend exposure limits. If user operations generate dust, fume or mist, use ventilation to keep exposure to airborne contaminants below the exposure limit.

Respiratory protection: Suitable respirator. Be sure to use an approved/certified or equivalent. Wear appropriate respirator when ventilation is inadequate.

Hand protection: Chemically compatible gloves.

Eye protection: Wear protective safety glasses.

Skin protection: Wear appropriate long-sleeved clothing to minimize skin contact.

Hygiene measures: Handle in accordance with good industrial hygiene and safety practice.

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 may be necessary to reduce emissions to acceptable levels.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

General information

Physical state: Liquid
Colour: Colourless
Odour: Aromatic

Safety data

pH: Not available
Boiling point/boiling range: 80˚C
Flash point: -11˚C
Flammability: Not applicable
Explosive properties: Not applicable
Oxidizing properties: Not applicable
Vapor pressure: 10 hPa at 20˚C and 100hPa at 79.7˚C
Water solubility: 1.88 g/l at 23.5˚C
Relative density (15.6°C): 0.8765 g/cm^3
Solubility: Not available
Log Octanol/Water partition coefficient: 2.13
Viscosity: 0.604 mPa at 25°C
Vapor density: Not available
Evaporation rate (butyl acetate=1): Not available

Other information:

Melting point/melting range: 5.5 °C
Auto-ignition temperature: 498°C

Section 10: STABILITY AND REACTIVITY

Stability: Stable under normal conditions.

Conditions to avoid: Heat, flames and sparks.

Materials to avoid: Acids, Bases, Halogens, Strong oxidizing agents, Metallic salts.

Hazardous Decomposition products: Carbon oxides.

Hazard polymerization: Not available.

Section 11: TOXICOLOGICAL INFORMATION

Potential acute health effects

Acute toxicity:

Product/ingredient name	Test	Species	Dose
Benzene	LD_{50}, Oral LD_{50}, Oral LC_{50}, Inhalation LC_{50}, Dermal	Rat Mouse Rat	1800 mg/kg 4700 mg/kg 10000 ppm/7H >5000 mg/kg

Inhalation: Toxic if inhaled. May cause respiratory tract irritation.

Ingestion: Toxic if swallowed. Aspiration hazard if swallowed - can enter lungs and cause damage.

Skin contact: Toxic if absorbed through skin. Causes skin irritation.

Eyes contact: Causes eye irritation.

Irritation and corrosivity: Irritating.

Skin Sensitization: Not sensitizing.

Toxicokinetics:
At low exposure levels, benzene is rapidly metabolized and excreted predominantly as conjugated urinary metabolites. At higher exposure levels, metabolic pathways appear to become saturated and a large portion of an absorbed dose of benzene is excreted as parent compound in exhaled air.

CMR Effects:

Carcinogenicity:
IARC-GROUP 1 – Carcinogenic to humans.
EPA-GROUP A – Human carcinogen.
NTP1 – Known to be carcinogenic.
Carcinogenic by OSHA.
Carcinogenic by NIOSH.
ACGIH A1: Confirmed Human Carcinogen.

Mutagenicity: Genotoxic.

Reproductive toxicity: No evidence of reproductive or developmental effects.

Repeated dose toxicity:
Inhalation: May cause bone marrow toxicity and depression of red and white blood cells.

Chronic/Other Effects
Carcinogen and an aspiration hazard (kinematic viscosity below 20.5 mm^2/s at 40°C).

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Experimental data from reliable studies are available for acute aquatic ecotoxicity endpoints. Data are not available for sediment or soil toxicity.

Substance name	Toxicity to fish	Toxicity to crustaceans	Toxicity to algae / terrestrial plants	Toxicity to other aquatic plants	Other toxicity data (birds, bees, plants etc.)
Benzene	LC_{50}/96H: 5.3 mg/l Long-term: (32 day NOEC) 0.8 mg/l	EC_{50}/48H (Daphnia): 10 mg/l Long term (7 day NOEC): 3 mg/l	Not available	EC_{50}/72H: 100 mg/l	Not available

Activated sludge respiration inhibition testing (24 hour IC_{50} - nitrification): 13 mg/l

Mobility: Not expected to adsorb to soil or sediment due to the low log Kow < 3.

Persistence and Degradability
Biotic - Readily biodegradable.
Abiotic - Will not undergo hydrolysis. Will not undergo photolysis. Expected to rapidly degrade by indirect photolysis in air.

Bioaccumulative potential: Not expected to bioaccumulate due to the low log Kow < 3.

Result of PBT / vPvB assessment (if CSR is required): Does not meet the criteria.

Other adverse effects:

Substances which have an unfavorable influence on the oxygen balance and can be measured using parameters such as BOD, COD, etc.: Not available.

Substances, which contribute to eutrophication: Not available

Remarks: Not available.

Section 13: DISPOSAL CONSIDERATIONS

Methods of disposal: Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Hazardous waste: Not available.

Section 14: TRANSPORT INFORMATION

International transport regulations

Regulatory Information	UN number	Proper shipping name	Class	Packing group	Label	Additional information	Marine pollutant
ADR/RID Class	1114	BENZENE	3	II			-
IMDG class	1114	BENZENE	3	II		EMS-No: F-E, S-D	No
IATA class	1114	BENZENE	3	II			-

National Fire Protection Association Hazard Ratings- NFPA (R):

Health Hazard - 2
Flammability - 3
Stability - 0

Section 15: REGULATORY INFORMATION

Chemical Safety Assessment has been performed for Benzene.

Classification and labeling according to EU Directives 67/548/EEC and 1999/45/EC (including amendments) and take into account the intended product use:

F – Highly flammable

T-Toxic

Risk phrases:
R11: Highly flammable.
R45: May cause cancer.
R46: May cause heritable genetic damage.
R36/38: Irritating to eyes and skin.
R48/23/24/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with the skin and if swallowed.
R65: Harmful: may cause lung damage if swallowed.

Safety advice:
S45: In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).
S53: Avoid exposure - obtain special instructions before use.

Classification and labeling according to EU Regulation (EC) 1272/2008 (CLP Regulation) and Globally Harmonized System (GHS):

Signal Word **Danger**

Dangerous as defined by the EU CLP 2008:

Physical/Chemical Properties:

Flammable liquids: Flam. Liquid cat. 2	H225: Highly flammable liquid and vapour.

Health Hazards:

Carcinogenicity: Carc. cat. 1A	H350: May cause cancer.
Germ cell mutagenicity: Muta. cat. 1B	H340: May cause genetic defects.
Specific target organ toxicity - repeated exposure: STOT RE 1	H372: Causes damage to organs through prolonged or repeated exposure.
Aspiration hazard: Asp. Tox. cat. 1	H304: May be fatal if swallowed and enters airways.
Eye irritation: Eye Irrit. cat. 2	H319: Causes serious eye irritation.
Skin corrosion / irritation: Skin Irrit. cat. 2	H315: Causes skin irritation.

Precautionary Statements
P202: Do not handle until all safety precautions have been read and understood.
P210: Keep away from heat, sparks, open flame, hot surfaces - no smoking.
P243: Take precautionary measures against static discharges.
P280: Wear protective gloves/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.
P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331: Do NOT induce vomiting.

National Paint & Coating Hazardous Materials Identification System – HMIS (R):

Health Hazard Rating -2
Flammability Rating - 3
Instability Rating - 0
Personal Protection - H

Section 16: OTHER INFORMATION

Full text of R-phrases referred to in sections 2 and 3:
R11: Highly flammable.
R45: May cause cancer.
R46: May cause heritable genetic damage.
R36/38: Irritating to eyes and skin.
R48/23/24/25: Toxic: danger of serious damage to health by prolonged exposure through inhalation, in contact with the skin and if swallowed.
R65: Harmful: may cause lung damage if swallowed.

Full text of Hazards Statements referred to in sections 2 and 3:
H225: Highly flammable liquid and vapour.
H350: May cause cancer.
H340: May cause genetic defects.
H372: Causes damage to organs through prolonged or repeated exposure.
H304: May be fatal if swallowed and enters airways.
H319: Causes serious eye irritation.
H315: Causes skin irritation.

Training advice: Before using / handling the product one must read carefully present MSDS.

Recommended restriction on use: *Should be used under Strictly Controlled Conditions (Article 18 (4)) for Intermediates under REACH.*

Key Legend Information:
ACGIH- American Conference of Govermental Industrial Hygienists
OSHA- Occupational Safety and Health Administration
NTP- National Toxicology program
IARC- International Agency for Research on Cancer
ND- Not Determined
N/A- Not available
R-phrases- Risk phrases
S-phrases- Safety phrases

Date of printing: 2.12.2010

Version no. 1

According to Regulation (EC) No. 1907/2006 (REACH), Annex II, Commission Directive 2001/59/EC and REGULATION (EC) No 1272/2008 (CLP).

Right to Know

Hazardous Substance Fact Sheet

Common Name: **BENZ(a)ANTHRACENE**

Synonyms: Naphthanthracene; Tetraphene

Chemical Name: Benz[a]Anthracene

Date: September 1998 Revision: August 2008

CAS Number: 56-55-3

RTK Substance Number: 0193

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE PAGE 6

Description and Use

Benz(a)Anthracene is an odorless, colorless to yellow brown flake, plate or powder. It is not produced commercially, but is used in research laboratories. It is also found in *Coal Tar*, roasted coffee, smoked foods, and automobile exhaust, and is formed as an intermediate during chemical manufacturing.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Benz(a)Anthracene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Benz(a)Anthracene** can affect you when inhaled.
- **Benz(a)Anthracene** should be handled as a CARCINOGEN and MUTAGEN--WITH EXTREME CAUTION.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheet on COAL TAR PITCH.*

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (as *Coal Tar Pitch Volatiles, Benzene-soluble fraction*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles, Cyclohexane-extractable fraction*) averaged over a 10-hour workshift.

ACGIH: Recommends that exposure by all routes be controlled to levels as low as possible.

- **Benz(a)Anthracene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing and wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benz(a)Anthracene**:

- No acute (short-term) health effects are known at this time.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Benz(a)Anthracene** and can last for months or years:

Cancer Hazard
- **Benz(a)Anthracene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes cancer in humans and it has been shown to cause liver and lung cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen. Such substance may also have the potential for causing reproductive damage in humans.

Reproductive Hazard
- According to the information presently available to the New Jersey Department of Health and Senior Services, **Benz(a)Anthracene** has not been tested for its ability to affect reproduction.

Other Effects
- No chronic (long-term) health effects are known at this time.

Medical

Medical Testing
There is no special test for this chemical. However, seek medical attention if illness occurs or overexposure is suspected.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when mixing, handling, or preparing **Benz(a)Anthracene**.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Benz(a)Anthracene**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile or Natural Rubber for gloves and DuPont Tyvek®, or the equivalent, as a protective material for clothing.

Eye Protection

- Wear eye protection with side shields or goggles.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles*), use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benz(a)Anthracene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benz(a)Anthracene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Benz(a)Anthracene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Benz(a)Anthracene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benz(a)Anthracene** is handled, used, or stored.
- **Benz(a)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **BENZ(a)ANTHRACENE**

Synonyms: Naphthanthracene; Tetraphene
CAS No: 56-55-3
Molecular Formula: $C_{18}H_{12}$
RTK Substance No: 0193
Description: Odorless, colorless to yellow brown flake, plate or powder

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class**: 9 (Environmentally hazardous substance)	**Benz(a)Anthracene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool.	**Benz(a)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).

SPILL/LEAKS

Isolation Distance:

Small Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit in sealed containers.

Bioaccumulation may occur in seafood**.**

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	May burn
Vapor Pressure:	2 mm Hg at 68°F (20°C)
Specific Gravity:	1.3 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	820°F (438°C)
Melting Point:	324°F (162°C)
Molecular Weight:	228.3

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA (as *Coal Tar Pitch Volatiles*, *Benzene soluble fraction*)
NIOSH:	0.1 mg/m^3, 10-hr TWA (as *Coal Tar Pitch Volatiles*, *Cyclohexane-extractable fraction*)
ACGIH:	Lowest level possible
IDLH:	80 mg/m^3 (as *Coal Tar Pitch Volatiles*)

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Natural Rubber
Coveralls:	DuPont Tyvek®
Respirator:	>0.1 mg/m^3 - Supplied Air

HEALTH EFFECTS

Eyes:	No information available
Skin:	No information available
Inhalation:	No information available
Chronic:	Cancer (liver and lung) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Transfer to a medical facility.

Right to Know
Hazardous Substance Fact Sheet

Common Name: **BENZO(a)PYRENE**

Synonyms: 3,4-Benzopyrene; B[a]P

Chemical Name: Benzo[a]pyrene

Date: July 1998 Revision: October 2007

CAS Number: 50-32-8

RTK Substance Number: 0207

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE PAGE 6

Description and Use

Benzo(a)pyrene is a pale yellow, crystalline solid or powder with a faint aromatic odor. In its pure form it is used as a laboratory reagent. It also forms as a gaseous by-product when certain carbon substances burn, such as coal tar chemicals, and is found in cigarette smoke.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Benzo(a)pyrene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Benzo(a)pyrene** can affect you when inhaled and by passing through the skin.
- **Benzo(a)pyrene** is a CARCINOGEN. HANDLE WITH EXTREME CAUTION.
- **Benzo(a)pyrene** may damage the developing fetus.
- Contact can irritate and burn the eyes.
- **Benzo(a)pyrene** can irritate the skin causing a rash or burning feeling on contact.
- Repeated exposure can cause thickening and darkening of the skin.
- Except in laboratories, **Benzo(a)pyrene** is usually found mixed with other "coal tar pitch" chemicals.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheets on COAL TAR PITCH, CREOSOTE, CHRYSENE, and ANTHRACENE.*

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing. Wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (as *Coal Tar Pitch Volatiles*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as the *Cyclohexane-extractable fraction*) averaged over a 10-hour workshift.

ACGIH: Recommends that exposure by all routes be controlled to levels as low as possible.

- **Benzo(a)pyrene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzo(a)pyrene**:

- Contact can irritate and burn the eyes.
- **Benzo(a)pyrene** can irritate the skin causing a rash or burning feeling on contact. Exposure to a combination of sunlight and this chemical can increase these effects.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(a)pyrene** and can last for months or years:

Cancer Hazard
- **Benzo(a)pyrene** is a PROBABLE CARCINOGEN in humans. There is some evidence that is causes stomach, skin, lung, blood, spleen, pancreas, and mammary cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Benzo(a)pyrene** may damage the developing fetus.
- There is limited evidence that **Benzo(a)pyrene** may damage the male and female reproductive systems.

Other Effects
- Repeated exposure can cause thickening and darkening of the skin and warts.

Medical

Medical Testing
There is no special test for this chemical. However, seek medical attention if illness occurs or overexposure is suspected.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Sunlight may cause a rash to develop in people exposed to **Benzo(a)pyrene** and increases the risk of skin cancer.
- Tobacco smoke also contains **Benzo(a)pyrene**. Smoking may increase the risk of lung cancer with exposure to **Benzo(a)pyrene.**

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.

- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when working with **Benzo(a)pyrene** in a laboratory.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Benzo(a)pyrene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend DuPont *Tychem® CPF-2, SL, CPF-4* and *Responder®* as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benzo(a)pyrene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benzo(a)pyrene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first to reduce dust or use a HEPA-filter vacuum for clean-up.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Benzo(a)pyrene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP), Nuclear Regulatory Commission (NRC) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Benzo(a)pyrene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benzo(a)pyrene** is handled, used, or stored.
- **Benzo(a)pyrene** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Benzo(a)pyrene** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **BENZO(a)PYRENE**

Synonyms: 3,4-Benzopyrene; B[a]P
CAS No: 50-32-8
Molecular Formula: $C_{20}H_{12}$
RTK Substance No: 0207
Description: Pale yellow, crystalline solid or powder

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Miscellaneous Hazardous Materials)	**Benzo(a)pyrene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE.	**Benzo(a)pyrene** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions.

SPILL/LEAKS

Isolation Distance: 50 meters (150 feet)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up.

Toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Faint aromatic odor
Flash Point:	No information
Specific Gravity:	1.35
Vapor Density:	8.7 (air = 1)
Vapor Pressure:	5.49 X 10^9 mm Hg at 77°F (25°C)
Water Solubility:	Insoluble
Boiling Point:	590° - 594°F (310° - 312°C)
Melting Point:	347° - 354 F (175 ° - 179°C)

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA
NIOSH:	0.1 mg/m^3, 10-hr TWA
ACGIH:	lowest level possible
IDLH LEVEL:	80 mg/m^3 (as *Coal Tar Pitch Volatiles*)

PROTECTIVE EQUIPMENT

Gloves:	No information
Coveralls:	DuPont Tychem®, CPF-2, SL, CPF-4, Responder® (all >8-hr permeation time)
Boots:	No information
Respirator:	>0.1 mg/m^3 - Supplied air

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation, rash and burning feeling
Chronic:	Cancer (stomach, skin, lung, blood, spleen, pancreas, and mammary) in animals. May affect the developing fetus Thickening and darkening of the skin and warts

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Transfer to a medical facility.

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **BENZO(b)FLUORANTHENE**

CAS Number: 205-99-2
DOT Number: None

RTK Substance number: 0208
Date: September 1995 Revision: July 2001

HAZARD SUMMARY

* **Benzo(b)fluoranthene** can affect you when breathed in and may be absorbed through the skin.
* **Benzo(b)fluoranthene** is a CARCINOGEN--HANDLE WITH EXTREME CAUTION.
* Contact with **Benzo(b)fluoranthene** can cause skin and eye irritation.
* Because the major hazards associated with **Benzo(b)fluoranthene** come from exposure to *Coal Tar Pitch, CONSULT THE NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES HAZARDOUS SUBSTANCE FACT SHEET ON COAL TAR PITCH.*

IDENTIFICATION

Benzo(b)fluoranthene is a colorless, needle-shaped solid. It is used as a research chemical and is present in coal, and coke oven emissions, and petroleum products.

REASON FOR CITATION

* **Benzo(b)fluoranthene** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, NIOSH, NTP, IARC, HHAG and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

The following exposure limits are for **Benzo(b)fluoranthene** (measured as *Coal Tar Pitch volatiles*):

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **0.1 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The recommended airborne exposure limit is **0.2 mg/m^3** averaged over an 8-hour workshift.

* **Benzo(b)fluoranthene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
* The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* A regulated, marked area should be established where **Benzo(b)fluoranthene** is handled, used, or stored.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Benzo(b)fluoranthene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Benzo(b)fluoranthene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzo(b)fluoranthene**:

* Contact with **Benzo(b)fluoranthene** can cause skin and eye irritation.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(b)fluoranthene** and can last for months or years:

Cancer Hazard

* **Benzo(b)fluoranthene** is a PROBABLE CARCINOGEN in humans. It has been shown to cause lung, liver and skin cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen. Such substances may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Benzo(b)fluoranthene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Benzo(b)fluoranthene** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

Examine your skin periodically for growths or changes in warts or moles. Skin cancers are usually easily curable when removed early.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **Benzo(b)fluoranthene** from drums or other storage containers to process containers.
* A Class I, Type B, biological safety hood should be used when mixing, handling, or preparing **Benzo(b)fluoranthene**.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Benzo(b)fluoranthene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Benzo(b)fluoranthene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Benzo(b)fluoranthene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Benzo(b)fluoranthene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Benzo(b)fluoranthene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
* When vacuuming, a high efficiency particulate air (HEPA) filter should be used, not a standard shop vacuum.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Benzo(b)fluoranthene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear impact resistant eye protection with side shields or goggles.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **0.1 mg/m^3** (as *Coal Tar Pitch volatiles*), use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **80 mg/m^3** (as *Coal Tar Pitch volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** (as *Coal Tar Pitch volatiles*) exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?
A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?
A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 292-5677 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **BENZO(b)FLUORANTHENE**
DOT Number: **None**
NAERG Code: **No Citation**
CAS Number: **205-99-2**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* **Benzo(b)fluoranthene** may burn, but does not readily ignite.
* Use dry chemical, CO_2, water spray, alcohol or polymer foam extinguishers.
* POISONOUS GASES ARE PRODUCED IN FIRE.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Benzo(b)fluoranthene** is spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate and wash area after clean-up is complete.
* It may be necessary to contain and dispose of **Benzo(b)fluoranthene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

* Prior to working with **Benzo(b)fluoranthene** you should be trained on its proper handling and storage.
* A regulated, marked area should be established where **Benzo(b)fluoranthene** is handled, used, or stored.
* **Benzo(b)fluoranthene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); OZONE; NITROGEN OXIDES; and SULFUR OXIDES.
* Store in tightly closed containers in a cool, well-ventilated area.

FIRST AID

In NJ, for POISON INFORMATION call 1-800-764-7661

Eye Contact
* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact
* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing
* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 5×10^{-7} mm Hg at 68°F (20°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Benz(e)acephenanthrylene
Other Names:
2,3-Benzfluoranthene; 3,4-Benzfluoranthene; B(b)F

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202 H4985

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **BENZO(k)FLUORANTHENE**

CAS Number: 207-08-9
DOT Number: None

RTK Substance number: 2969
Date: October 2002

HAZARD SUMMARY

* **Benzo(k)Fluoranthene** can affect you when breathed in and may be absorbed through the skin.
* **Benzo(k)Fluoranthene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
* Contact can irritate the skin and eyes.

IDENTIFICATION

Benzo(k)Fluoranthene is a pale yellow, needle-like solid. It is primarily found in smoke from tobacco and polluted air.

REASON FOR CITATION

* **Benzo(k)Fluoranthene** is on the Hazardous Substance List because it is cited by NTP, IARC, HHAG and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Benzo(k)Fluoranthene**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* **Benzo(k)Fluoranthene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
* It should be recognized that **Benzo(k)Fluoranthene** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Benzo(k)Fluoranthene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Benzo(k)Fluoranthene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzo(k)Fluoranthene**:

* Contact can irritate the skin and eyes.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(k)Fluoranthene** and can last for months or years:

Cancer Hazard

* **Benzo(k)Fluoranthene** may be a CARCINOGEN in humans since it has been shown to cause skin cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen. Such substances may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Benzo(k)Fluoranthene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Benzo(k)Fluoranthene** has not been adequately tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Benzo(k)Fluoranthene** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Benzo(k)Fluoranthene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Benzo(k)Fluoranthene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Benzo(k)Fluoranthene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Benzo(k)Fluoranthene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Benzo(k)Fluoranthene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Benzo(k)Fluoranthene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* At any exposure level, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?
A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?
A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **BENZO(k)FLUORANTHENE**
DOT Number: **None**
NAERG Code: **No Citation**
CAS Number: **207-08-9**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* Use dry chemical, CO_2, water spray, or foam extinguishers.
* POISONOUS GASES ARE PRODUCED IN FIRE.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Benzo(k)Fluoranthene** is spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
* Remove all ignition sources.
* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate and wash area after clean-up is complete.
* It may be necessary to contain and dispose of **Benzo(k)Fluoranthene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

* Prior to working with **Benzo(k)Fluoranthene** you should be trained on its proper handling and storage.
* **Benzo(k)Fluoranthene** is not compatible with OZONE; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); NITROGEN; and SULFUR OXIDES.
* Store in tightly closed containers in a cool, well-ventilated area.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

* Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing

* Remove the person from exposure.

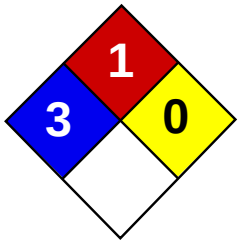
PHYSICAL DATA

Vapor Pressure: 0 mm Hg at 68°F (20°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Benzo(k)Fluoranthene
Other Names:
8,9-Benzofluoranthene; B(k)F

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202



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

CI#: 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.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water, hot water, methanol, diethyl ether, n-octanol.

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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Right to Know
Hazardous Substance Fact Sheet

Common Name: **CHRYSENE**

Synonyms: Benzo(a)phenanthrene

Chemical Name: Chrysene

Date: December 1999 Revision: June 2008

CAS Number: 218-01-9

RTK Substance Number: 0441

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE PAGE 6

Description and Use

Chrysene is a colorless to white, crystalline solid which is used in research laboratories. It is most often found as the gaseous by-product from the incomplete combustion of fossil fuel, wood, *Coal Tar* and *Creosote*.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	3	-
FLAMMABILITY	0	-
REACTIVITY	1	-

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE
DOES NOT BURN

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Chrysene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Chrysene** can affect you when inhaled and by passing through the skin.
- **Chrysene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- Inhaling **Chrysene** may irritate the nose and throat.
- If skin contaminated with **Chrysene** is exposed to sunlight, a rash or sunburn effect and permanent changes in skin pigment can occur
- **Chrysene** is almost always found in *Coal Tar Pitch, Creosote*, or other *Coal Tar Products*. If you work with *Coal, Tar, Soot, Pitch, Asphalt*, etc., you may be exposed to **Chrysene**.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheets on COAL TAR PITCH, CREOSOTE* and *ANTHRACENE*.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing and wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (as *Coal Tar Pitch Volatiles, Benzene-soluble fraction*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles, Cyclohexane-extractable fraction*) averaged over a 10-hour workshift.

ACGIH: Recommends that exposure by all routes be controlled to levels as low as possible.

- **Chrysene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Chrysene**:

- Contact can irritate the skin and eyes.
- Inhaling **Chrysene** may irritate the nose and throat causing coughing and wheezing.
- If skin contaminated with **Chrysene** is exposed to sunlight, a rash or sunburn effect can occur, sometimes with blisters.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Chrysene** and can last for months or years:

Cancer Hazard
- **Chrysene** may be a CARCINOGEN in humans since it has been shown to cause skin, liver, and lung cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen. Such substance may also have the potential for causing reproductive damage in humans.

Reproductive Hazard
- According to the information presently available to the New Jersey Department of Health and Senior Services, **Chrysene** has not been tested for its ability to affect reproduction.

Other Effects
- Permanent changes in skin pigment can occur if contaminated skin is exposed to sunlight

Medical

Medical Testing
- There is no special test for this chemical. However, an exposed person should examine their skin periodically for growths, changes in warts or moles, and sores that do not heal. Skin cancer is easily cured when detected and treated early.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Persons who smoke cigarettes and are exposed to **Chrysene** may be at increased risk for lung cancer. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when mixing, handling, or preparing **Chrysene**.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Chrysene**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile or Natural Rubber for gloves and DuPont Tyvek®, or the equivalent, as protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m^3** (as *Coal Tar Pitch Volatiles*), use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Where the potential for high exposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- DOES NOT BURN
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Chrysene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Chrysene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Chrysene** you should be trained on its proper handling and storage.

- **Chrysene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Common Name: **CHRYSENE**

Synonyms: Benzo(a)phenanthrene
CAS No: 218-01-9
Molecular Formula: $C_{18}H_{12}$
RTK Substance No: 0441
Description: Colorless to white, crystalline solid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **0 - Fire** **1 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Miscellaneous Hazardous Materials)	DOES NOT BURN Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool.	**Chrysene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).

SPILL/LEAKS

Isolation Distance:
Spill: 25 meters (75 feet)
Fire: 800 meters (1/2 mile)
Moisten spilled material first or use a HEPA-filter vacuum for clean-up.
DO NOT wash into sewer.
May biodegrade in water.

PHYSICAL PROPERTIES

Odor Threshold:	Unknown
Flash Point:	Noncombustible
Vapor Pressure:	6.3 x 10.9 mm Hg at 68°F (20°C)
Specific Gravity:	1.27 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	838°F (448°C)
Melting Point:	491° to 493°F (255° to 256°C)
Ionization Potential:	7.59+/-0.2 eV
Molecular Weight:	228.3

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA
NIOSH:	0.1 mg/m^3, 10-hr TWA
ACGIH:	Lowest level possible
IDLH:	80 mg/m^3
	(All of the above as *Coal Tar Pitch Volatile*)

PROTECTIVE EQUIPMENT

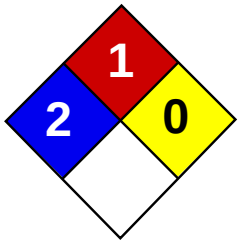
Gloves:	Nitrile or Natural Rubber
Coveralls:	DuPont Tyvek®
Respirator:	>0.1 mg/m^3 - Supplied air >80 mg/m3 - SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation, rash or sunburn with blisters can occur if contaminated skin is exposed to sunlight
Inhalation:	Nose and throat irritation with coughing and wheezing
Chronic:	Cancer (skin, liver, lungs) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
Remove contaminated clothing and wash contaminated skin with soap and water.
Transfer to a medical facility.



Health	2
Fire	1
Reactivity	0
Personal Protection	E

Material Safety Data Sheet
Copper MSDS

Section 1: Chemical Product and Company Identification

Product Name: Copper

Catalog Codes: SLC4939, SLC2152, SLC3943, SLC1150, SLC2941, SLC4729, SLC1936, SLC3727, SLC5515

CAS#: 7440-50-8

RTECS: GL5325000

TSCA: TSCA 8(b) inventory: Copper

CI#: Not available.

Synonym:

Chemical Name: Not available.

Chemical Formula: Cu

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
Copper	7440-50-8	100

Toxicological Data on Ingredients: Copper LD50: Not available. LC50: Not available.

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).

Potential Chronic Health Effects:
CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to lungs, mucous membranes. 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. 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: Not available.

Ingestion:
Do not induce vomiting. 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: Not available.

Flash Points: Not available.

Flammable Limits: Not available.

Products of Combustion: Some metallic oxides.

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:
SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray, fog or foam. Do not use water jet.

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. 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. Empty containers pose a fire risk, evaporate the residue under a fume hood. Ground all equipment containing material. Do not breathe dust. Avoid contact with eyes Wear suitable protective clothing In case of insufficient ventilation, wear suitable respiratory equipment If you feel unwell, seek medical attention and show the label when possible.

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. Combustible materials should be stored away from extreme heat and away from strong oxidizing agents.

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: 1 (mg/m3) from ACGIH [1990] Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Solid.

Odor: Not available.

Taste: Not available.

Molecular Weight: 63.54 g/mole

Color: Not available.

pH (1% soln/water): Not applicable.

Boiling Point: 2595°C (4703°F)

Melting Point: 1083°C (1981.4°F)

Critical Temperature: Not available.

Specific Gravity: 8.94 (Water = 1)

Vapor Pressure: Not applicable.

Vapor Density: Not available.

Volatility: Not available.

Odor Threshold: Not available.

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold 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: Not available.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Eye contact. Inhalation. Ingestion.

Toxicity to Animals:
LD50: Not available. LC50: Not available.

Chronic Effects on Humans: The substance is toxic to lungs, mucous membranes.

Other Toxic Effects on Humans:
Very hazardous in case of ingestion. Hazardous in case of inhalation. Slightly hazardous in case of skin contact (irritant).

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans: Human: passes through the placenta, excreted in maternal milk.

Special Remarks on other Toxic Effects on Humans: Not available.

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: Not a DOT controlled material (United States).

Identification: Not applicable.

Special Provisions for Transport: Marine Pollutant

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: Copper Massachusetts RTK: Copper TSCA 8(b) inventory: Copper CERCLA: Hazardous substances.: Copper

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada): CLASS D-2A: Material causing other toxic effects (VERY TOXIC).

DSCL (EEC): R36- Irritating to eyes.

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:

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: 10/09/2005 04:58 PM

Last Updated: 05/21/2013 12:00 PM

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SAFETY DATA SHEET

Issuing Date 18-May-2015 **Revision Date** 24-Sep-2015 **Revision Number** 1

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Number	**556**
Product Name	**Cyanide**
Synonyms	None

Recommended use of the chemical and restrictions on use

Recommended Use	Laboratory use only
Uses advised against	No information available

Details of the supplier of the safety 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 Number	In case of EMERGENCY call CHEMTREC Day or Night 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

Emergency Overview

Signal word **Danger**

Hazard Statements

Causes severe skin burns and eye damage

Appearance Clear, colorless **Physical state** Liquid->Liquid **Odor** Odorless

Precautionary Statements - Prevention

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
Unknown Toxicity
0 % of the mixture consists of ingredient(s) of unknown toxicity
Other information

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
Sodium Hydroxide	1310-73-2	0.5

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 effects, both acute and delayed

Most Important Symptoms and Effects Burning sensation.

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 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.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

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 containment and cleaning up

Methods for containment Prevent further leakage or spillage if safe to do so.

Methods for cleaning up Soak up with inert absorbent material. Pick up and transfer to properly labeled containers.

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 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
Sodium Hydroxide 1310-73-2	Ceiling: 2 mg/m³	TWA: 2 mg/m³ (vacated) Ceiling: 2 mg/m³	IDLH: 10 mg/m³ Ceiling: 2 mg/m³

Appropriate engineering controls

Engineering Measures Showers
Eyewash stations
Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/face protection Face protection shield.
Skin and body protection Wear protective gloves and protective clothing. Long sleeved clothing. Chemical resistant apron. Impervious gloves.
Respiratory protection No protective equipment is needed under normal use conditions. If exposure limits are exceeded or irritation is experienced, ventilation and evacuation may be required.
Hygiene Measures Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Wear suitable gloves and eye/face protection. Do not eat, drink or smoke when using this product. Take off contaminated clothing and wash before reuse. Contaminated work clothing should not be allowed out of the workplace. Regular cleaning of equipment, work area and clothing is recommended. Wash hands before breaks and immediately after handling the product. For environmental protection, remove and wash all contaminated protective equipment before re-use.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical state Liquid->Liquid
Appearance Clear, colorless
Color No information available
Odor Odorless
Odor Threshold No information available

Property	Values	Remarks Method
pH	13.1	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/water	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	no data available	
Oxidizing properties	no data available	

Other Information

Softening Point no data available
Particle Size no data available
Particle Size Distribution

10. STABILITY AND REACTIVITY

Reactivity

no data available.

Chemical stability
Stable under recommended storage conditions.
Possibility of Hazardous Reactions
None under normal processing.
Hazardous Polymerization
Hazardous polymerization does not occur.
Conditions to avoid
Exposure to air or moisture over prolonged periods.
Incompatible materials
Acids. Bases. Oxidizing agent.
Hazardous Decomposition Products
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
Sodium Hydroxide 1310-73-2	-	= 1350 mg/kg (Rabbit)	-

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 information available.
Carcinogenicity Contains no ingredient listed as a carcinogen.

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)
Sodium Hydroxide 1310-73-2		96h LC50: = 45.4 mg/L (Oncorhynchus mykiss)		

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 P098

California Hazardous Waste Codes 122

Chemical Name	California Hazardous Waste
Sodium Hydroxide 1310-73-2	Toxic Corrosive

14. TRANSPORT INFORMATION

DOT Not regulated
Proper Shipping Name NON REGULATED
Hazard Class N/A

TDG Not regulated

MEX Not regulated

ICAO Not regulated

IATA Not regulated

Special Provisions None

IMDG Not regulated
Special Provisions None
Marine Pollutant Not applicable

RID 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 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	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
Sodium Hydroxide 1310-73-2	1000 lb			X

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
Sodium Hydroxide 1310-73-2	1000 lb		RQ 1000 lb final RQ RQ 454 kg final RQ

US State Regulations

California Proposition 65

This product contains the following Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

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International Regulations

Component	Carcinogen Status	Exposure Limits
Sodium Hydroxide 1310-73-2 (0.5)		Mexico: Ceiling 2 mg/m³

Canada
WHMIS Hazard Class
Not determined

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** X

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Product Stewardship
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1-800-572-6501

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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

End of Safety Data Sheet

Right to Know

Hazardous Substance Fact Sheet

Common Name: **DIBENZ(a,h)ANTHRACENE**

Synonyms: 1,2,5,6-DBA; 1,2,5,6-Dibenzanthracene

Chemical Name: Dibenz[a,h]Anthracene

Date: August 2010

CAS Number: 53-70-3

RTK Substance Number: 0622

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Description and Use

Dibenz(a,h)Anthracene is a colorless, white or light yellow, crystalline (sand-like) solid. It is used as a research chemical and is found bound to particulate matter in urban air, industrial emissions and cigarette smoke. **Dibenz(a,h)Anthracene** has not been produced in the United States since 1978.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Dibenz(a,h)Anthracene** is on the Right to Know Hazardous Substance List because it is cited by DOT, NTP, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Dibenz(a,h)Anthracene** can affect you when inhaled.
- **Dibenz(a,h)Anthracene** should be handled as a CARCINOGEN and MUTAGEN--WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes. Prolonged or repeated contact can cause a skin rash, dryness and redness. Exposure to sunlight can greatly aggravate these effects.
- Exposure can irritate the nose and throat.
- Exposure to **Dibenz(a,h)Anthracene** can cause headache, dizziness, nausea and vomiting.
- **Dibenz(a,h)Anthracene** may affect the liver and kidneys.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

No occupational exposure limits have been established for **Dibenz(a,h)Anthracene**. However, it may pose a health risk. Always follow safe work practices.

- **Dibenz(a,h)Anthracene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Dibenz(a,h)Anthracene**:

- Contact can irritate the skin and eyes.
- Prolonged or repeated contact can cause a skin rash, dryness and redness. Exposure to sunlight can greatly aggravate these effects.
- Inhaling **Dibenz(a,h)Anthracene** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Dibenz(a,h)Anthracene** can cause headache, dizziness, nausea and vomiting.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Dibenz(a,h)Anthracene** and can last for months or years:

Cancer Hazard
- **Dibenz(a,h)Anthracene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes lung, skin, mammary, and other types of cancers.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- There is limited evidence that **Dibenz(a,h)Anthracene** may damage the developing fetus in animals.

Other Effects
- **Dibenz(a,h)Anthracene** may affect the liver and kidneys.

Medical

Medical Testing
If symptoms develop or overexposure is suspected, the following are recommended:

- Liver and kidney function tests

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Dibenz(a,h)Anthracene**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when mixing, handling, or preparing **Dibenz(a,h)Anthracene**.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Dibenz(a,h)Anthracene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Natural Rubber for gloves, and Tyvek®, or the equivalent, as a protective clothing material.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- At any detectable concentration, use a NIOSH approved negative pressure, air-purifying, particulate filter respirator with an N, R or P100 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Dibenz(a,h)Anthracene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Dibenz(a,h)Anthracene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Dibenz(a,h)Anthracene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Dibenz(a,h)Anthracene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Dibenz(a,h)Anthracene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Dibenz(a,h)Anthracene** is handled, used, or stored.
- **Dibenz(a,h)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area away from SUNLIGHT.
- Sources of ignition, such as smoking and open flames, are prohibited where **Dibenz(a,h)Anthracene** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **DIBENZ(a,h)ANTHRACENE**

Synonyms: 1,2,5,6-DBA; 1,2,5,6-Dibenzanthracene
CAS No: 53-70-3
Molecular Formula: $C_{22}H_{14}$
RTK Substance No: 0622
Description: Colorless, white or light yellow, crystalline solid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Environmentally Hazardous Substance)	**Dibenz(a,h)Anthracene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool.	**Dibenz(a,h)Anthracene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). Protect from SUNLIGHT.

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.

DO NOT wash into sewer.

Dibenz(a,h)Anthracene may bioaccumulate in sea food.

PHYSICAL PROPERTIES

Vapor Pressure:	1×10^{-10} mm Hg at 68°F (20°C)
Specific Gravity:	1.28 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	975°F (524°C)
Melting Point:	511° to 513°F (266° to 267°C)
Molecular Weight:	278.36

EXPOSURE LIMITS

No occupational exposure limits have been established for **Dibenz(a,h)Anthracene**.

The Protective Action Criteria values are:

PAC-1 = 0.0025 mg/m^3
PAC-2 = 0.015 mg/m^3
PAC-3 = 15 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Natural Rubber
Coveralls:	Tyvek®
Respirator:	Full facepiece APR with P100 filters >15 mg/m^3 - SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation, skin rash, dryness and redness
Inhalation:	Nose and throat irritation with coughing and wheezing
	Headache, dizziness, nausea and vomiting
Chronic:	Cancer (lung, skin, mammary) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Safety Data Sheets (SDS)

SECTION 1-IDENTIFICATION

Product name: Ethylbenzene

Other names: ─

Proper shipping name: Ethylbenzene

Recommended use of the chemical and restrictions on use:
The main use of ethylbenzene is to manufacture styrene, a compound used to make plastics. Ethylbenzene is also found in gasoline, paints, inks, insecticides, carpet glues and tobacco products.

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

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:

Flammable Liquid Category 2
Acute Toxicity (Inhalation) Category 4
Skin Corrosion/Irritation Category 3
Serious Eye Damage/Eye Irritation Category 2
Carcinogenicity Category 2
Reproductive Toxicity Category 2
Specific Target Organ Toxicity Repeated Exposure Category 2
Aspiration Hazard Category 1

GHS Label elements:

Hazard symbols

Signal word

Danger

Hazard statements

Flammable liquid and vapor
Harmful if inhaled
Causes skin irritation
Causes serious eye irritation
Suspected of causing cancer
May damage the unborn child
May be harmful to organs by prolonged and repeated exposure
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 vapors and contact with skin and eyes.
Wear breathing apparatus/protective gloves/face protection.
Store in well-ventilated place.
Disposal must be in accordance with applicable federal, state, or local regulations.

Other hazards: ─

SECTION 3-COMPOSITION/INFORMATION ON INGREDIENTS

CAS No.	Chemical Name	wt% by weight	EINECS No.
00100-41-4	Ethylbenzene	99.0 min.	202-849-4
Synonyms	Phenylethane、EB、Ethylbenzol		

SECTION 4-FIRST AID MEASURES

Description of necessary first aid measures

Eye:

1. Flush eye with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids.
2. Get medical aid immediately.

Skin:

1. Washing affected area thoroughly with soap and water for at least 20 minutes.
2. Call a Physician if irritation develops or persists.
3. Removing contaminated clothing, shoes, and leathery wearings, cleaning procedure is available before reused or waste treatment.

Ingestion:

1. If victim is conscious and alert, give 2～4 cupfuls of milk/water to dilute the substance in stomach.
2. Never give anything by mouth to an unconscious person.
3. Don't induce vomiting unless directed to do so by medical person.
4. Then seek for medical attention.

Inhalation:

1. Remove from further exposure and flush thoroughly with air.
2. If not breathing, give artificial respiration. If breathing is difficult, give Oxygen.
3. If respiratory irritation, seek immediate medical assistance and call a physician.

Most important symptoms/effects, acute and delayed

Headaches, dizziness, fatigue, eye, nose and throat irritation. Target organs: Eyes, upper respiratory system, skin, CNS, lung, liver, kidney, skin (dermatitis), eye (conjuntivitis and other eye injuries), upper respiratory system disorders, and central nervous system disorders.

Indication of immediate medical attention and special treatment needed, if necessary

For acute or short term repeated exposures to Ethylbenzene:

Inhalation:

1. Severe exposures should have cardiac monitoring to detect arrhythmia.
2. If bronchospasm and wheezing occur, consider treatment with inhaled sympathomimetic agents.
3. If pulmonary edema (noncardiogenic) occurs, then maintain ventilation and oxygenation with close arterial blood gas monitoring. Early use of PEEP and mechanical ventilation may be needed to maintain pO2 greater than 50 mmHG with FIO2 less than 60%.

Ingestion:

1. Induction of emesis is not recommended.
2. Cautious gastric lavage followed by administration of activated charcoal may be of benefit if the patient is seen soon after the exposure.

SECTION 5-FIRE FIGHTING MEASURES

Extinguishing media

Foam、CO_2、Dry chemical powder、Water spray or fog – Large fires only.

Specific hazards arising from the chemical

1. Liquid and vapor are flammable.
2. Moderate fire hazard when exposed to heat or flame.
3. Vapor forms an explosive mixture with air.
4. Moderate explosion hazard when exposed to heat or flame.
5. Vapor may travel a considerable distance to source of ignition.
6. Heating may cause expansion or decomposition leading to violent rupture of containers.
7. On combustion, may emit toxic fumes of carbon monoxide (CO).

Special protective equipment and precautions for fire-fighters

1. Must wear MSHA/NOISH approved positive self-contained breathing apparatus（SCBA）and protective clothing.
2. Withdrawing and isolation the possible dangerous sources, fire fighting at safe distance and suitable protection area. Keep toxic vapors and decompositions away from inhalation, when standing at upper-wind area as well.
3. Stop leakage before fire extinguishing, otherwise it may explode again because of vapors above leakage. However, it's not well extinguishment at nondangerous circumstance, preferring to burning up.
4. Water spray may not work effectively in terms of lower flash point. Better fire fighting performed by experienced people.
5. In huge fire at larger area, automatic water spray system should be recommended. If extinguishing is not available, evacuating people back as soon as possible.
6. Out off the space immediately, if vessel collapsed or pressure relief valve went pop.

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. Iron, galvanized iron, and steel are suitable metals for tanks.
2. Storage should be located away from any area subject to fire hazards. Storage tanks located in the open or underground minimize the danger of fire, vapor and health problems.
3. All openings in the system should terminate outdoors and be protected by flash screen.
4. Electrical installation should conform to the National Electrical Code.
5. Storage tanks should be electrically bonded and grounded to prevent dangerous accumulations of static electricity. (see NFPA pamphlet “Static Electricity”)
6. Natural ventilation is all that is needed for outdoor storage installation.
7. For indoor storage : Good natural ventilation may be sufficient. The generally considered maximum allowable concentration is 100 ppm by volume in air for an eight-hour working exposure. If other than natural ventilation is required,

the ventilation equipment should be designed to handle the heavy ethylbenzene vapor. Since ethylbenzene vapor is heavier than air, a down draft mechanical exhaust is indicated in those operation in which general ventilation should be to ensure a substantial air flow away from the work area. All ventilating systems require periodic inspection.

SECTION 8-EXPOSURE CONTROLS, PERSONAL PROTECTION

Control parameters

OSHA- Final PELs : 100 ppm TWA.
ACGIH TLV-TEL : 100 ppm.
ACGIH TLV-STEL : 125 ppm.
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 ethylbenzene vapor.
2. In venting ethylbenzene 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.
3. Process should be designed so that the operator is not exposed to direct contact with ethylbenzene 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 ethylbenzene 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

Personal respirators (NIOSH Approved):
If the exposure limit is exceeded, a half-face organic vapor respirator may be worn for up to ten times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. A full-face piece organic vapor respirator may be worn up to 50 times the exposure limit or the maximum use concentration specified by the appropriate regulatory agency or respirator supplier, whichever is lowest. For emergencies or instances where the exposure levels are not known, use a full-face piece positive-pressure, air-supplied respirator.
(Warning: Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.)

Skin protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls, as appropriate, to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 9-PHYSICAL AND CHEMICAL PROPERTIES

Appearance : Transparent liquid	Upper/lower explosive limits : 1.0%～6.7%
Odor: Aromatic odor	Vapor Pressure : 7.1 mmHg @20℃/68℉
Odor threshold : 0.092～0.6 ppm	Vapor Density : 3.66 (air=1)
PH : Not available	Relative density : 0.864 (water=1)
Melting/Freezing Point : －94.9℃	Solubility : 0.015 @25℃ in water
Initial boiling point/boiling range : 132.6℃	Partition coefficient : 3.15 (n-octanol/water)
Flash point : 21℃	Auto-ignition temperature : 432℃
Evaporation Rate : 0.84 (BuAc=1)	Decomposition temperature : Not available
Flammability (solid/gas) : Not available	Viscosity : Not available
Molecular Formula : C_8H_{10}	Molecular Weight : 106.7

SECTION 10-STABILITY AND REACTIVITY

Reactivity

The product is stable. Vapor is explosive when exposed to heat or flame.

Chemical stability

Stable under normal temperatures and pressures.

Possibility of hazardous reaction

Has not been reported.

Condition to avoid
Incompatible materials, ignition sources, excess heat.

Incompatible materials
Oxidizing agents.

Hazardous decomposition products
Carbon dioxide and carbon monoxide may form when heated to decomposition.

SECTION 11-TOXICOLOGICAL INFORMATION

Routes of exposure
Eye, Skin, inhalation, Ingestion.

Symptoms (treatments as indicated in Section 4)
Eye:
May cause irritation, redness, pain, and corneal damage.

Skin:
Causes irritation to skin. Symptoms include redness, itching, and pain. May produce blisters. May be absorbed through the skin.

Ingestion:
May cause irritation to the gastrointestinal tract. Symptoms may include nausea, vomiting and diarrhea. May cause central nervous system depression. Symptoms may include giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

Inhalation:
Inhalation of high concentrations of gas/vapor causes lung irritation with coughing and nausea, central nervous depression with headache and dizziness, slowing of reflexes, fatigue and inco-ordination. Central nervous system (CNS) depression may include general discomfort, symptoms of giddiness, headache, dizziness, nausea, anaesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

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. Limited evidence suggests that repeated or long-term occupational exposure may produce cumulative health effects involving organs or biochemical systems. Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Aggravation of pre-existing conditions:
Persons with pre-existing skin disorders, eye problems, liver disease, central nervous system disorders, or impaired respiratory function may be more susceptible to the effects of the substance.

Toxicity
LD50: 3500 mg/kg (rat, oral)
LC50: 4000 ppm/4h (rat, inhalation)

Irritation
Skin (rabbit): 15 mg/24h Mild
Eye (rabbit): 500 mg- SEVERE

Chronic effect
Carcinogenicity:
ACGIH : A3- Proven for animals.
OSHA : Classified None.
IARC : Group 2B carcinogen.

Epidemiology:
Not available.

Teratogenicity:
Not available.
Reproductive Effects:
Not available.

Neurotoxicity:
Not available

Mutagenicity:
Mutation in mammalian somatic cells（Rodent, mouse）Lymphocyte=80mg/L.

SECTION 12-ECOLOGICAL INFORMATION

Ecotoxicity
LC_{50} (96 hr.) Fish: 32.0～97.1 mg/l
EC_{50} (48 hr.) Water flea: Not available
Biocencentration factor (BCF): Not available

Persistence and degradability

1. In the atmosphere, it exists primarily in the vapor phase based on its vapor pressure. It photochemically degrades by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially returns to the earth in rain.
2. Degradation occurs faster under smog conditions. Photooxidation products include ethylphenol, benzaldehyde, acetophenone and m- and p- ethylnitrobenzene.
3. In water, ethylbenzene's concentration decreases by evaporation and biodegradation. The rate of decrease is dependent on the season. Half-lives in water range from several days to 2 weeks.
4. Some ethylbenzene is absorbed by sediment, but bioconcentration in fish is not expected to be significant.

Half-life (Air): 8.56～85.6 hr
Half-life (Surface water): 72～240 hr
Half-life (Ground water): 144～5472 hr
Half-life (Soil): 7.2～240 hr

Bioaccumulative potential
This material is not expected to significantly bioaccumulate.

Mobility in soil
Ethylbenzene is adsorbed moderately by soil. It does not significantly hydrolyze in either water or 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

US DOT	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
	Packing Group	II		
Sea(IMO/IMDG)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3.2		
	UN Number	1175		
	Packing Group	II		
Air(ICAO/IATA)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	Subsidiary Class	1175		
	Packing Group	II		

EUROPEAN RID/ADR (ADR/RID)	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
Canadian TDG	Shipping Name	ETHYLBENZENE	Hazard Labels	
	Hazard Class	3		
	UN Number	1175		
	Packing Group	II		
	Subsidiary Class	9.2		

SECTION 15-REGULATORY INFORMATION

US FEDERAL

TSCA

CAS# 100-41-4 is listed on the TSCA inventory.

Health & Safety Reporting List

CAS# 100-41-4：Effective Date：June 19, 1987；Sunset Date：June 19, 1997

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# 100-41-4：final RQ＝1000 pounds（454 kg）

Section 302（TPQ）

None of the chemicals in this product have a TPQ.

SARA Codes

CAS# 100-41-4：acute, chronic, flammable.

Section 313

This material contains Ethylbenzene（CAS# 100-41-4, 99.0% ）,which is subject to the reporting requirements of Section 313 of SARA Title III and 40 CFR Part 372.

Clean Air Act

CAS# 100-41-4 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 Water Act

CAS# 100-41-4 is listed as a hazardous Substance under the CWA.

CAS# 100-41-4 is listed as a Priority Pollutant under the Clean Water Act.

CAS# 100-41-4 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

Ethylbenzene can be found on the following state right to know lists : California, New Jersey, Florida, Pennsylvania, Minnesota, Massachusetts.

California No Significant Risk Level：None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols : XN F

Risk Phrases : R 11 Highly flammable.

R 20 Harmful by inhalation.

Safety Phrases : S 16 Keep away form sources of ignition-No smoking.

S 24/25 Avoid contact with skin and eyes.

S 29 Do not empty into drains.

CANADA

CAS# 100-41-4 is listed on Canada’s DSL/NDSL list.

This product has a WHMIS classification of B2, D2B.

CAS# 105-05-5 is not listed on Canada's Ingredient Disclosure List.

SECTION 16-OTHER INFORMATION

References and sources

1. CHEMINFO Data Bank, CCINFO CD, 2005-3
2. HSDB Data Bank, TOMES PLUS CD, Vol.65,2005
3. RETECS Data Bank, TOMES PLUS CD, Vol.65, 2000
4. Hazardous Substance Data Bank, Environment Protection, Administration, Executive Yuan, ROC (Taiwan)
5. Chemwatch Data Bank, 2005-1
6. SDS, GHS in Taiwan, Council of Labor Affairs, Executive Yuan, ROC (Taiwan)

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	08/21/2008	Updated each section by GHS SDS.
Version 6	08/01/2011	Checked each section by SHE
Prepared by	Safety & Environment Protection Section, Taiwan SM Corporation Kaohsiung Plant.	

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **INDENO (1,2,3-cd) PYRENE**

CAS Number: 193-39-5
DOT Number: UN 3077
DOT Hazard Class: 9 (Environmentally Hazardous Substance)

RTK Substance number: 3052
Date: May 2000 Revision: March 2007

HAZARD SUMMARY

* **Indeno (1,2,3-cd) Pyrene** can affect you when breathed in and may be absorbed through the skin.
* **Indeno (1,2,3-cd) Pyrene** is a CARCINOGEN--HANDLE WITH EXTREME CAUTION.
* No acute (short-term) health effects are known at this time.

IDENTIFICATION

Indeno (1,2,3-cd) Pyrene is a yellow plate or needle-shaped solid. It is a research chemical and a component of gasoline engine exhaust and tobacco smoke. There is no commercial production or known use of this compound.

REASON FOR CITATION

* **Indeno (1,2,3-cd) Pyrene** is on the Hazardous Substance List because it is cited by DOT, NTP, DEP, IARC, IRIS and EPA.
* This chemical is on the Special Health Hazard Substance List because it is a **CARCINOGEN**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Indeno (1,2,3-cd) Pyrene**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* **Indeno (1,2,3-cd) Pyrene** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
* It should be recognized that **Indeno (1,2,3-cd) Pyrene** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Indeno (1,2,3-cd) Pyrene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Indeno (1,2,3-cd) Pyrene** to potentially exposed workers.

This Fact Sheet is a summary source of information of all potential and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Indeno (1,2,3-cd) Pyrene**:

* No acute (short-term) health effects are known at this time.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Indeno (1,2,3-cd) Pyrene** and can last for months or years:

Cancer Hazard

* **Indeno (1,2,3-cd) Pyrene** may be a CARCINOGEN in humans since it has been shown to cause skin and lung cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen. Such substances may also have the potential for causing reproductive damage in humans.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Indeno (1,2,3-cd) Pyrene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Indeno (1,2,3-cd) Pyrene** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

There is no special test for this chemical. However, if illness occurs or overexposure is suspected, medical attention is recommended.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **Indeno (1,2,3-cd) Pyrene** from drums or other storage containers to process containers.
* A Class I, Type B, biological safety hood should be used when mixing, handling, or preparing **Indeno (1,2,3-cd) Pyrene**.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Indeno (1,2,3-cd) Pyrene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Indeno (1,2,3-cd) Pyrene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Indeno (1,2,3-cd) Pyrene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Indeno (1,2,3-cd) Pyrene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Indeno (1,2,3-cd) Pyrene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
* When vacuuming, a high efficiency particulate air (HEPA) filter should be used, not a standard shop vacuum.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Clothing

* Avoid skin contact with **Indeno (1,2,3-cd) Pyrene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Eye protection is included in the recommended respiratory protection.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

* At any exposure level, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Should I be concerned if a chemical causes cancer in animals?
A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is assigned by the Chemical Abstracts Service to identify a specific chemical.

CFR is the Code of Federal Regulations, which consists of the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **INDENO (1,2,3-cd) PYRENE**
DOT Number: **UN 3077**
DOT Hazard Class: **9 (Environmentally Hazardous Substance)**
NAERG Code: **171**
CAS Number: **193-39-5**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

FIRE HAZARDS

* Extinguish fire using an agent suitable for type of surrounding fire. **Indeno (1,2,3-cd) Pyrene** itself does not burn.
* POISONOUS GASES ARE PRODUCED IN FIRE.
* If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

SPILLS AND EMERGENCIES

If **Indeno (1,2,3-cd) Pyrene** is spilled, take the following steps:

* Evacuate personnel and secure and control entrance to the area.
* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate and wash area after clean-up is complete.
* It may be necessary to contain and dispose of **Indeno (1,2,3-cd) Pyrene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

* Prior to working with **Indeno (1,2,3-cd) Pyrene** you should be trained on its proper handling and storage.
* Store in tightly closed containers in a cool, well-ventilated area.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

* Remove contaminated clothing. Wash contaminated skin with soap and water.

Breathing

* Remove the person from exposure.

PHYSICAL DATA

Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:
Indeno [1,2,3-cd] Pyrene
Other Names:
1,10-(1,2-Phenylene)Pyrene; o-Phenylenepyrene

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

Material Safety Data Sheet: Isopropylbenzene [Cumene]

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Product name	**Isopropylbenzene [Cumene]**
Effective date	March 25, 2013
Synonyms	Isopropylbenzene, cumol, 2-phenylepropane, (1-methylethyl) benzene, cumene
Chemical formula	$(CH_3)_2\ CHC_6\ H_5$
CAS name & no.	Benzene, (1-methylethyl), 98-82-8
Manufacturer's name and address	Axiall, LLC P.O. Box 1959 Pasadena, TX 77501
Emergency telephone number	For transportation emergencies: CHEMTREC: (800) 424-9300 USA and Canada +1-703-527-3887 International (collect calls accepted) For all other emergencies: (225) 685-2500
MSDS contact	Corporate Health & Safety Department P.O. Box 629 Plaquemine, LA 70765 Phone Number (225) 685-2500

2. COMPOSITION/INFORMATION ON INGREDIENTS

Component	CAS No.	Wt.%.
Isopropylbenzene [Cumene]	98-82-8	>99.90

3. HAZARDS IDENTIFICATION

PRECAUTIONARY INFORMATION

Flammable liquid. Eye, skin and respiratory tract irritant. May cause narcosis. Causes dizziness, drowsiness and unconsciousness.

POTENTIAL HEALTH EFFECTS

Primary Routes of Entry

Inhalation, ingestion, skin, and eye contact.

Acute Effects

Isopropylbenzene may act as a central nervous system depressant and a narcotic. Inhalation of high vapor concentrations may cause dizziness, slight incoordination, and unconsciousness. This chemical may also be toxic to the liver, spleen, and gall bladder, but there is little human evidence of these effects. This chemical is also a skin and eye irritant.

Chronic Effects

Prolonged skin contact may result in skin rashes. Chronic experiments in animals found isopropylbenzene to cause damage to the spleen and fatty changes in the liver.. Subacute inhalation experiments showed no significant changes in peripheral blood, but exhibited some liver, kidney, and lung effects.

Potential Adverse Chemical Interactions

Persons with kidney diseases, liver diseases, skin diseases or respiratory diseases, especially obstructive airway disease, may be at increased risks due to the toxic effects of isopropylbenzene on these organs.

Carcinogen Status

Isopropylbenzene is not considered to be carcinogenic by OSHA, NIOSH, NTP, IARC, or EPA.

The National Toxicology Program conducted a two-year study titled "Toxicology and Carcinogenesis Studies of Cumene in F344/N Rats and B6C3F1 Mice (Inhalation Studies)". The NTP report concluded that exposure to cumene in air resulted in,

> "…increased occurrences of adenomas of the epithelium of the nose in male and female rats, of renal tubule adenoma or carcinoma (combined), of adenomas and carcinomas of the lung in male and female mice, and of liver neoplasms in female mice. The occurrence of interstitial cell adenoma of the testis in male rats and hemangiosarcomas of the spleen and follicular cell adenomas of the thyroid gland in male mice may also have been associated with exposure to cumene."

3. HAZARDS IDENTIFICATION (continued)

Cumene is not currently considered to be carcinogenic by OSHA, NIOSH, NTP, IARC or EPA. However, cumene is classified as A3 by the ACGIH, meaning it is a confirmed animal carcinogen with unknown relevance to humans. The agent is carcinogenic in experimental animals at a relatively high dose, by route(s) of administration, at site(s), of histologic type(s), or by mechanism(s) that may not be relevant to worker exposure. Available epidemiologic studies do not confirm an increased risk of cancer in exposed humans. Available evidence does not suggest that the agent is likely to cause cancer in humans except under uncommon or unlikely routes or levels of exposure

4. FIRST AID MEASURES

Inhalation

If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, begin artificial respiration and if heart action has stopped, CPR. Get medical attention as soon as possible.

Skin Contact

If this chemical contacts the skin, flush the contaminated skin with copious quantities of water for at least 15 minutes. If this chemical penetrates the clothing, immediately remove clothing and flush the skin with water promptly. If irritation persists after washing, get medical attention.

Eye Contact

If the chemical contacts the eyes, immediately wash the eyes with large amounts of room temperature water for at least 15 minutes, occasionally lifting the lower and upper lids. Get medical attention immediately.

Ingestion

If the chemical is ingested do not induce vomiting. Get medical attention immediately.

5. FIRE FIGHTING MEASURES

Flash Point	44°C (closed cup)
Flammable Limits (% By Vol.)	
Lower Explosive Limit (LEL)	0.9
Upper Explosive Limit (UEL)	6.5
Autoignition Temperature	425° C

Fire Fighting Procedures/Fire Extinguishing Media

Keep unnecessary people away; isolate hazard area and deny entry. Avoid breathing vapors, stay upwind. Use NIOSH approved self-contained respirator in the positive pressure mode as combustion of isopropylbenzene produces toxic vapors. Structural firefighter's protective clothing is NOT effective for this material. Use an acceptable halon replacement such as carbon dioxide extinguishers, alcohol foam or dry chemical for small fires. Large fires should be extinguished

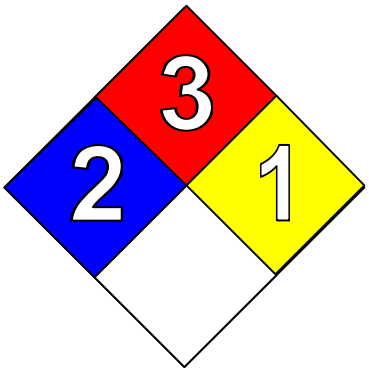
5. FIRE FIGHTING MEASURES (continued)

with alcohol foam. Water sprays may be used to keep the containers cool but may be insufficient to extinguish the fire. Direct water streams may promote the spread of isopropylbenzene flames, as isopropylbenzene is lighter than water. Stay away from ends of tanks. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. Isolate for 1/2 mile in all directions if tank, rail car or truck is involved in fire.

Unusual Fire and Explosion Hazards

Dangerous fire and explosion hazard when exposed to heat or flame. Isopropylbenzene vapor forms explosive mixtures in air. Flowing isopropylbenzene may ignite by self-generated static electricity. Do not weld, cut, drill, grind, or perform similar operations on or near containers (even empty containers, as even residues of isopropylbenzene can ignite explosively).

Isopropylbenzene vapors are heavier than air and may travel back a considerable distance to a source of ignition and flash back. Containers exposed to heat from fires should be cooled with water to prevent vapor pressure buildup, which could result in container rupture. Combustion of isopropylbenzene produces irritants and toxic gases.



National Fire Protection Association Hazard Rating
4 = Extreme
3 = High
2 = Moderate
1 = Slight
0 = Insignificant

6. ACCIDENTAL RELEASE MEASURES

Shut off all sources of ignition. No smoking or flares allowed in the spill area. Restrict access to spill area, and move unprotected personnel upwind of the area. Keep out of low areas. Allow only trained personnel wearing appropriate protective clothing and self-contained respirator in the vicinity of the spill. Do not touch spilled material; stop leak if you can without risk. If fire potential exists, cover spill with foam. Prevent isopropylbenzene from entering water bodies, drains and any sewage collection systems. Isopropylbenzene will float on water and the runoff will present an explosion or fire hazard. For small spills take up with sand or other non-combustible absorbent material, and place into containers for later disposal. Control large spills by diking. Dispose all spill material in accordance with federal, state and local regulations. Isopropylbenzene spills over the reportable quantity (5,000 lbs) should be reported to the National Response Center (800-424-8802).

7. HANDLING AND STORAGE

Store in a well ventilated place away from sources of ignition, and oxidizing agents and in accordance with 29 CFR 1910.106. Store in metal containers. Ground and bond all storage and transfer equipment to prevent possible ignition from static sparks. Use spark resistant equipment (tools) in the isopropylbenzene area. Store in an area equipped with automatic sprinklers or fire extinguishing system. Wear appropriate protective equipment when handling isopropylbenzene. All seals, gaskets, liners and other such parts exposed to isopropylbenzene service should be made of aromatic resistant elastomers. Do not use rubber- lined tanks. Since emptied containers retain product residues, assume emptied containers to have the same hazards as full containers. Follow all federal, state and local regulations as well as all insurance codes when storing and handling isopropylbenzene.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Respiratory Protection

Use appropriate NIOSH approved respirators in accordance with 29 CFR 1910.132 and 1910.134, to prevent overexposure. Respirators must be selected based on the airborne levels found in the workplace and must not exceed the working limits of the respirator.

Eye Protection

Use splash proof chemical safety goggles or appropriate full-face respirator. Follow the eye and face protection guidelines of 29 CFR 1910.132 and 1910.133. Where there is any possibility that an individual's eyes may be exposed to isopropylbenzene, an eye wash fountain (in accordance with 29 CFR 1910.151) should be within the immediate work area for emergency use.

Protective Gloves

Use gloves in accordance with 29 CFR 1910.132 and 29 CFR 1910.138.

Ventilation

Provide local ventilation to maintain exposure levels below recommended exposure limits, and to prevent accumulation of isopropylbenzene in explosive levels. Use explosion proof ventilation equipment. Local exhaust ventilation should comply with OSHA regulations and the American Conference of Governmental Industrial Hygienists, Industrial Ventilation - A Manual of Recommended Practice.

Exposure Guidelines

The OSHA-PEL, NIOSH-REL and ACGIH-TLV for Isopropylbenzene [Cumene] is 50 ppm (8-hr TWA). The IDLH is 900 ppm [10% LEL].

Other

Where there is a possibility of exposure of an individual's body to isopropylbenzene, facilities for quick drenching of the body should be provided (in accordance with 29 CFR 1910.151) within the immediate work area for emergency use. Such individuals should be provided with and required to use impervious clothing in accordance with 29 CFR 1910.132.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Clear colorless liquid
Odor	Sharp penetrating aromatic odor
Molecular Weight	120.2
Boiling Point	152°C
Melting Point	-96°C
Solubility	Insoluble in water, soluble in alcohol, ether, benzene, and chlorinated solvents
Specific Gravity (Water = 1.0)	0.86
Vapor Density (Air = 1.0)	4.14
Vapor Pressure	3.2 mm Hg @ 20°C
pH	Not Available

10. STABILITY AND REACTIVITY

Stability
Stable under normal conditions.

Polymerization
Hazardous polymerization does not occur.

Hazardous Decomposition Products
Combustion products of isopropylbenzene may include styrene, benzaldehyde, acetophenone, benzene, carbon monoxide, and carbon dioxide. Other unidentified organic compounds may be formed during combustion.

Incompatible Materials
Violent reactions may take place between isopropylbenzene and nitric acid, oleum and chlorsulphonic acid. Isopropylbenzene reacts with oxidizing agents to form isopropylbenzene hydroperoxide, which may cause explosive hazards.

11. TOXICOLOGICAL INFORMATION

Animal Toxicity:

Oral:	Rat LD_{50}	1.4 g/kg
Inhalation:	Rat LC_{LO}	8,000 ppm (4hr)
	Mouse LC_{LO}	5,042 ppm (2hr)
	Human LC_{LO}	200 ppm (somnolence, irritability)

LC_{LO} = Lowest air concentration that is lethal to a given species in a given time.
LC_{50} = Dose that is lethal to 50% of a given species by a given route of exposure.

Animal experiments indicate that isopropylbenzene may be toxic at very high concentrations to the spleen and liver. Cataract formation has also been observed in experimental animals exposed to high concentrations of isopropylbenzene vapor.

12. ECOLOGICAL INFORMATION

Environmental Fate: The following information on isopropylbenzene [cumene] is extracted from the TOXNET database maintained by the National Library of Medicine.

Atmosphere: According to a model of gas/particle partitioning of semi-volatile organic compounds in the atmosphere, cumene, which has a vapor pressure of 4.5 mm Hg at 25 deg C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase cumene is degraded in the atmosphere by reaction with photochemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 2.5 days, calculated from its rate constant of $6.5x10^{-12}$ cu cm/molecule-sec at 25 deg C. Vapor-phase cumene is also degraded in the atmosphere by reaction with ozone radicals; the half-life for this reaction in air is estimated to be 3 yrs, calculated from its estimated rate constant of $1.0x10^{-20}$ cu cm/molecule-sec at 25 deg C.

Terrestrial: Based on a classification scheme, an estimated Koc value of 820, determined from a structure estimation method, indicates that cumene is expected to have low mobility in soil. Volatilization of cumene from moist soil surfaces is expected to be an important fate process given a Henry's Law constant of 0.0115 atm-cu m/mole. The potential for volatilization of cumene from dry soil surfaces may exist based upon a vapor pressure of 4.5 mm Hg. However, adsorption to soil is expected to attenuate volatilization. After a 10 and 20 day exposure of wastewater inoculum to cumene, a theoretical BOD of 62% and 70% was observed, respectively. Based on these results, cumene is expected to undergo considerable biodegradation in soil environments.

Aquatic: Based on a classification scheme, an estimated Koc value of 820, determined from an estimation method, indicates that cumene is expected to adsorb to sediment and suspended solids in water. Volatilization from water surfaces is expected based upon a Henry's Law constant of 0.0115 atm-cu m/mole. Using this Henry's Law constant and an estimation method, volatilization half-lives for a model river and model lake are 1.2 hrs and 4.4 days, respectively. In natural waters, cumene is degraded by reaction with hydroxyl radicals; the half-life for this reaction in water is estimated to be 107 days, calculated from its rate constant of $7.5x10^{9}$ L/mol sec at pH 7.

Biodegradation: Aerobic: Using river water and sediment in a test system, the aerobic biodegradation of cumene was

12. ECOLOGICAL INFORMATION (continued)

studied in a closed system. The disappearance rate constant of cumene (avg concn 2.5 mg/l) for total mineralization was 0.02/day; this equates to a half-life of 34.6 days. However, when volatilization was considered coupled with biodegradation, the half-life for cumene became 2.5 days. Cumene biodegradation experienced a lag time of approximately 5 days. Based on the results of this experiment, residence time of cumene in aquatic ecosystems will likely be brief.

Anaerobic: In an in-situ anaerobic biodegradation study of various alkyl benzene compounds, cumene was found to undergo considerable biodegradation. Biodegradation proceeded via methanogenic and fermentative bacteria.

Ecotoxicity:

LC_{50} Daphnia magna 0.6 ppm/48 hr /Conditions of bioassay not specified
LD_{50} Agelaius phoeniceus (red-winged blackbird) oral 98 mg/kg
Mytilus edulis (mussel larvae): no significant alteration of growth rate at concentrations of 1 to 50 ppm.

13. DISPOSAL CONSIDERATIONS

Waste Management Information: Any disposal practice must be in compliance with local, state and federal laws and regulations.

14. TRANSPORTATION INFORMATION

Proper shipping name	Isopropylbenzene
DOT Hazard class	3, (Flammable liquid)
DOT Shipping I.D. No.	UN 1918
PG	III
Labeling	Flammable
RQ	Cumene

15. REGULATORY INFORMATION

Regulatory information is not meant to be all-inclusive. It is the user's responsibility to ensure compliance with federal, state or provincial and local laws.

SARA Title III

Section 302 and 304 of the Emergency Planning and Community Right to Know Act; Extremely Hazardous Substances (40 CFR 355)

COMPONENT	CAS No.	TPQ (lbs)	RQ
None	Not Applicable	Not Applicable	Not Applicable

NOTE: TPQ - Threshold Planning Quantity RQ - Reportable Quantity

Section 311 and 312 Hazard Categorization (40 CFR 370)

ACUTE	CHRONIC	FIRE	PRESSURE	REACTIVE
X		X		

Section 313 Toxic Chemicals (40 CFR 372.65)

COMPONENT	CAS No.	WT. %
Isopropylbenzene	98-82-8	> 99.90

CERCLA

Section 102(a) Hazardous Substances (40 CFR 302.4)

COMPONENT	CAS No.	WT. %	RQ (lbs)
Isopropylbenzene	98-82-8	>99.90	5,000

RCRA

40 CFR 261.21 Hazardous Waste Number:
Commercial or technical grade cumene that is disposed of because it does not meet product specifications or is otherwise contaminated would be regulated as a listed hazardous waste. The waste code for commercial chemical product cumene is U055. Discarded off-specification or contaminated cumene would also likely exhibit the hazardous waste characteristic for ignitability. The waste code for ignitable waste is D001.

TSCA

Isopropylbenzene is listed on the TSCA inventory.

Canadian Regulations

This product has been classified according to the hazard criteria of the Canadian Controlled Products Regulations, Section 33 and the MSDS contains all information required by this regulation. WHMIS Classification- BD2

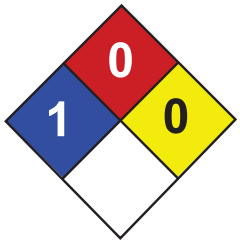
Canadian Environmental Protection Act (CEPA)

Isopropylbenzene is listed on the Canadian Domestic Substance List (DSL)

16. OTHER INFORMATION

IMPORTANT: The information and data herein are believed to be accurate and have been compiled from sources believed to be reliable. It is offered for your consideration, investigation and verification. Buyer assumes all risk of use, storage and handling of the product in compliance with applicable federal, state and local laws and regulations. **Axiall, LLC MAKES NO WARRANTY OF ANY KIND, EXPRESS OR IMPLIED, CONCERNING THE ACCURACY OR COMPLETENESS OF THE INFORMATION AND DATA HEREIN.** Axiall will not be liable for claims relating to any party's use of or reliance on information and data contained herein regardless of whether it is claimed that the information and data are inaccurate, incomplete or otherwise misleading. This information relates to the material designated and may not be valid for such material used in combination with any other materials nor in any process.

MSDS Status: Revision Date: 3/25/2013 Supersedes: 03/19/2008



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

CI#: 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.

Ionicity (in Water): Not available.

Dispersion Properties: Not available.

Solubility: Insoluble in cold water.

Section 10: Stability and Reactivity Data

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 abssorbed 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 has found to cause reproductive harm (male) which would require a warning under the statute: Lead 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 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: 06/09/2012 12:00 PM

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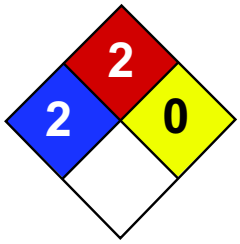
```
ERROR: undefined
OFFENDING COMMAND: get

STACK:

/quit
-dictionary-
-mark-
```



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

CI#: 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.

Special Remarks on the Products of Biodegradation: Not available.

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

SAFETY DATA SHEET

Revision Date 10-Feb-2015 **Revision Number** 1

1. Identification

Product Name **n-Butylbenzene**

Cat No. : **AC107850000; AC107850010; AC107850050; AC107850500; AC107852500**

Synonyms 1-Phenylbutane

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)

Flammable liquids	Category 3

Label Elements

Signal Word
Warning

Hazard Statements
Flammable liquid and vapor

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

Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower

Fire
In case of fire: Use CO2, dry chemical, or foam for extinction

Storage
Store in a well-ventilated place. Keep cool

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 %
Butyl benzene	104-51-8	> 99

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 not breathing, give artificial respiration. Obtain medical attention.

Ingestion Do not induce vomiting. Clean mouth with water. Aspiration hazard. Get medical attention.

Most important symptoms/effects Breathing difficulties. Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray. Carbon dioxide (CO_2). Dry chemical. Use water spray to cool unopened containers. chemical foam. Do not use a solid water stream as it may scatter and spread fire.

Unsuitable Extinguishing Media No information available

Flash Point 59 °C / 138.2 °F
Method - No information available

Autoignition Temperature 412 °C / 773.6 °F
Explosion Limits
Upper 5.80%
Lower .80%
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Combustible material. Flammable. Vapors may travel to source of ignition and flash back. Containers may explode when heated.

Hazardous Combustion Products
Carbon monoxide (CO) Carbon dioxide (CO_2)
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	Flammability	Instability	Physical hazards
0	2	0	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment.
Environmental Precautions See Section 12 for additional ecological information.

Methods for Containment and Clean Up 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 and eyes. Do not breathe dust. Do not breathe vapors or spray mist. Use explosion-proof equipment. Use only non-sparking tools.

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

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.

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	Colorless
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	-88 °C / -126.4 °F
Boiling Point/Range	183 °C / 361.4 °F @ 760 mmHg
Flash Point	59 °C / 138.2 °F
Evaporation Rate	No information available
Flammability (solid,gas)	No information available

Flammability or explosive limits	
Upper	5.80%
Lower	.80%
Vapor Pressure	1.33 hPa @ 23 °C
Vapor Density	4.6
Relative Density	0.860
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	412 °C / 773.6 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C10 H14
Molecular Weight	134.22

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. Incompatible products.

Incompatible Materials Strong oxidizing agents, oxygen

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 No acute toxicity information is available for this product

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
Butyl benzene	104-51-8	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 None known

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Symptoms of overexposure may be headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information

Component	EU - Endocrine Disrupters Candidate List	EU - Endocrine Disruptors - Evaluated Substances	Japan - Endocrine Disruptor Information
Butyl benzene	Group III Chemical	Not applicable	Not applicable

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.

Persistence and Degradability No information available

Bioaccumulation/ Accumulation No information available.

Mobility .

Component	log Pow
Butyl benzene	4.2

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** UN2709
- **Hazard Class** 3
- **Packing Group** III

TDG

- **UN-No** UN2709
- **Hazard Class** 3
- **Packing Group** III

IATA

- **UN-No** 2709
- **Proper Shipping Name** BUTYLBENZENES
- **Hazard Class** 3
- **Packing Group** III

IMDG/IMO

- **UN-No** 2709
- **Proper Shipping Name** BUTYLBENZENES
- **Hazard Class** 3
- **Packing Group** III

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Butyl benzene	X	X	-	203-209-7	-		X	X	X	X	-

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	Yes
Sudden Release of Pressure Hazard	No
Reactive Hazard	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
Butyl benzene	-	X	X	-	-

U.S. Department of Transportation

Reportable Quantity (RQ):	N
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 B2 Flammable liquid

16. Other information

Prepared By
Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date 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

PCE
Material Safety Data Sheet

Manufacturer's Name:	Martin Asphalt Company	Date: January 15, 2014
Telephone Number:	800-662-0987	Address: 300 Christy Place South Houston, TX 77587
For Emergency Assistance Call: (713) 941-4410		

NFPA HAZARD IDENTIFICATION	DEGREE OF HAZARD	HAZARD RATINGS
	HEALTH: 0 FIRE: 0 REACTIVITY: 0	0= LEAST 1= SLIGHT 2= MODERATE 3= HIGH 4= EXTREME

SECTION 1 - COMPONENT DATA	
PRODUCT NAME:	PCE/LVOC-1
COMMON NAME	BLENDED PETROLEUM HYDROCARBON
CHEMICAL NAME	BLENDED PETROLEUM HYDROCARBON

SECTION 2 - PHYSICAL DATA				
C.A.S. NUMBER:	MIXTURE (SEE DATA BELOW)			
BOILING POINT (°F):	212			
SPECIFIC GRAVITY (H20=1):	0.93			
MELTING POINT (°F):	NA			
VAPOR PRESSURE:	17.535 (GAUGE)			
PERCENT VOLATILE:	0			
VAPOR DENSITY (AIR=1):	NA			
EVAPORATIVE RATE (EE=1):	NA			
SOLUBILITY IN WATER:	SOLUBLE			
APPEARANCE AND ODOR:	LIGHT BROWN LIQUID, FAINT PETROLEUM ODOR			
COMPONENT NAME/ CAS NO.	% MIN	% MAX	EXPOSURE LIMITS	UNITS
HEAVY PARAFFINIC DISTILLATE SOLVENT EXTRACT (HPDSE)/64742-04-7	50	70	OSHA PEL (OIL MIST) 8HR/TWA (OIL MIST)	5 mg/m3 0.2mg/m3
EMULSIFIER/ LISTED IN TSCA	0	10	ORAL LD50 (RATS)	<19g/kg

SECTION 3 - FIRE & EXPLOSION DATA	
FLASH POINT (^{O}F) & METHOD:	HPDSE: 410 / C.O.C.
FLAMMABILITY LIMITS:	LOWER: NA UPPER: NA
AUTO IGNITION TEMPERATURE (°F):	UNKNOWN
EXTINGUISHING MEDIA	USE DRY CHEMICAL, FOAM OR CARBON DIOXIDE.
SPECIAL FIRE FIGHTING PROCEDURES	WATER MAY BE INEFFECTIVE BUT CAN BE USED TO COOL CONTAINERS EXPOSED TO HEAT OR FLAME. CAUTION SHOULD BE EXERCISED WHEN USING WATER OR FOAM AS FROTHING MAY OCCUR, ESPECIALLY IF SPRAYED INTO CONTAINERS OF HOT, BURNING LIQUID.
UNUSUAL FIRE AND EXPLOSIVE CONDITIONS	DENSE SMOKE MAY BE GENERATED WHILE BURNING. CARBON MONOXIDE, CARBON DIOXIDE AND OTHER OXIDES MAY BE GENERATED AS PRODUCTS OF COMBUSTION.

*NA=NOT APPLICABLE **ND=NOT DETERMINED

SECTION 4 - REACTIVITY DATA	
STABILITY: STABLE	STABLE
CONDITIONS TO AVOID:	NONE
HAZARDOUS POLYMERIZATION:	WILL NOT OCCUR
INCOMPATIBILITY MATERIALS TO AVOID:	MAY REACT WITH STRONG OXIDIZING AGENTS
HAZARDOUS DECOMPOSITION PRODUCTS:	NONE

SECTION 5 - HEALTH HAZARD DATA	
SKIN CONTACT:	AVOID SKIN CONTACT, THIS PRODUCT MAY CAUSE SLIGHT SKIN IRRITATION UPON DIRECT CONTACT; BASED ON TESTING OF SIMILAR PRODUCTS AND/OR COMPONENTS. PROLONGED OR REPEATED CONTACT MAY RESULT IN CONTACT DERMATITIS WHICH MAY MAKE THE SKIN MORE SUSCEPTIBLE TO OTHER IRRITANTS, SENSITIZERS AND DISEASE. PROLONGED OR REPEATED CONTACT MAY RESULT IN OIL ACNE WHICH IS CHARACTERIZED BY BLACKHEADS WITH POSSIBLE SECONDARY INFECTION. CONSTITUENTS OF THIS PRODUCT HAVE BEEN ASSOCIATED WITH PHOTOSENSITIVITY AN ABNORMAL SENSITIVITY OF SKIN TO SUNLIGHT. SEE DATA HEALTH BELOW
EYE CONTACT:	THIS PRODUCT IS RELATIVELY NON-IRRITATING TO THE EYES UPON DIRECT CONTACT BASED ON TESTING OF SIMILAR PRODUCTS AND/OR COMPONENTS.
INHALATION:	THIS PRODUCT HAS A LOW VAPOR PRESSURE AND IS NOT EXPECTED TO PRESENT AN INHALATION HAZARD AT AMBIENT CONDITION. CAUTION SHOULD BE TAKEN TO PREVENT AEROSOLIZATION OR MISTING OF THIS PRODUCT. THE PERMISSIBLE EXPOSURE LIMIT (PEL) AND THRESHOLD LIMIT VALUE (TLV) FOR THIS PRODUCT AS OIL MIST IS 5 mg/m3 APPEAR TO BE WITHOUT SIGNIFICANT HEALTH RISK. THE SHORT-TERM EXPOSURE LIMIT FOR THIS PRODUCT AS AN OIL MIST IS 10 mg/m3.
INGESTION	DO NOT INGEST. THIS PRODUCT IS RELATIVELY NON- TOXIC BY INGESTION. THIS PRODUCT HAS LAXATIVE PROPERTIES AND MAY RESULT IN ABDOMINAL CRAMPS AND DIARRHEA. SEE HEALTH DATA BELOW.
HEALTH DATA	ON RARE OCCASIONS, PROLONGED AND REPEATED EXPOSURE TO OIL MIST POSES A RISK OF PULMONARY DISEASE SUCH AS CHRONIC LUNG INFLAMMATION. THIS CONDITION IS USUALLY ASYMPTOMATIC AS A RESULT OF REPEATED SMALL ASPIRATIONS. SHORTNESS OF BREATH AND COUGH ARE THE MOST COMMON SYMPTOMS. THE PETROLEUM OIL USED FOR THIS PRODUCT IS CLASSIFIED AS CARCINOGENIC BY THE INTERNATIONAL AGENCY FOR RESEARCH OF CANCER. TO MINIMIZE EXPOSURE, DO NOT SUBJECT EMULSION TO TEMPERATURES ABOVE 212ºF. TEMPERATURES IN THIS RANGE VOLATILIZE THE EMULSION.

SECTION 6 - EMERGENCY AND FIRST AID PROCEDURES	
EYE CONTACT	IMMEDIATELY FLUSH EYES WITH LARGE AMOUNTS OF WATER AND CONTINUE FLUSHING UNTIL IRRITATION SUBSIDES. IF MATERIAL IS HOT, TREAT FOR THERMAL BURNS AND TAKE VICTIM TO HOSPITAL IMMEDIATELY.
SKIN CONTACT	REMOVE CONTAMINATED CLOTHING. WASH CONTAMINATED AREA THOROUGHLY WITH SOAP AND WATER. IF REDNESS OR IRRITATION OCCURS, SEEK MEDICAL ATTENTION. IF MATERIAL IS HOT, SUBMERGE INJURED AREA IN COLD WATER. IF VICTIM IS SEVERLEY BURNED, REMOVE TO A HOSPITAL IMMEDIATELY.
INHALATION	THIS MATERIAL HAS A LOW VAPOR PRESSURE AND IS NOT EXPECTED TO PRESENT AN INHALATION EXPOSURE AT AMBIENT CONDITIONS.
INGESTION	DO NOT INDUCE VOMITING. SEEK MEDICAL ATTENTION.

*NA=NOT APPLICABLE **ND=NOT DETERMINED

SECTION 7 - PERSONAL HEALTH PROTECTION INFORMATION	
EYE PROTECTION	EYE PROTECTION IS NOT REQUIRED UNDER CONDITIONS OF NORMAL USE. IF MATERIAL IS HANDLED SUCH THAT IT COULD BE SPLASHED INTO EYES, WEAR PLASTIC FACE SHIELD OR SPLASH-PROOF SAFETY GOGGLES.
SKIN PROTECTION	NO SKIN PROTECTION IS REQUIRED FOR SINGLE SHORT DURATION EXPOSURES, USE IMPERVIOUS CLOTHING (BOOTS, GLOVES, APRONS, ETC.) OVER PARTS OF THE BODY SUBJECT TO EXPOSURE. IF HANDLING HOT MATERIAL, USE INSULATED PROTECTIVE CLOTHING (BOOTS, GLOVES, APRONS, ETC.) LAUNDER SOILED CLOTHES. PROPERLY DISPOSE OF CONTAMINATED LEATHER ARTICLES INCLUDING SHOES, WHICH CANNOT BE DECONTAMINATED.
RESPIRATORY PROTECTION	RESPIRATORY PROTECTION IS NOT REQUIRED UNDER CONDITIONS OF NORMAL USE. IF VAPOR OR MIST IS GENERATED WHEN THE MATERIAL IS HEATED OR HANDLED, USE AN ORGANIC VAPOR RESPIRATOR WITH A DUST AND MIST FILTER. ALL RESPIRATORS MUST BE NIOSH CERTIFIED. DO NOT USE COMPRESSED OXYGEN IN HYDROCARBON ATMOSPHERES.
VENTILATION	IF VAPOR OR MIST IS GENERATED WHEN THE MATERIAL IS HEATED OR HANDLED, ADEQUATE VENTILATION IN ACCORDANCE WITH GOOD ENGINEERING PRACTICE MUST BE PROVIDED TO MAINTAIN CONCENTRATIONS BELOW THE SPECIFIED EXPOSURE OR FLAMMABLE LIMITS.
OTHER	CONSUMPTION OF FOOD AND BEVERAGES SHOULD BE AVOIDED IN WORK AREAS WHERE HYDROCARBONS ARE PRESENT. ALWAYS WASH HANDS AND FACE WITH SOAP AND WATER BEFORE EATING, DRINKING, OR SMOKING.

SECTION 8 - SPILL, LEAK & DISPOSAL PROCEDURES	
STEPS TO BE TAKEN IF MATERIAL IS RELEASED OR SPILLED	CONSULT HEALTH HAZARD DATA IN SECTION 5, PERSONAL HEALTH PROTECTION INFORMATION IN SECTION 7, FIRE & EXPLOSION DATA IN SECTION 3, AND REACTIVITY DATA IN SECTION 4. NOTIFY APPROPRIATE AUTHORITIES OF SPILL. CONTAIN SPILL IMMEDIATELY. DO NOT ALLOW SPILL TO ENTER SEWERS OR WATERCOURSES. REMOVE ALL SOURCES OF IGNITION. ABSORB WITH APPROPRIATE INERT MATERIAL SUCH AS SAND, CLAY, ETC. LARGE SPILLS MAY BE PICKED UP USING VACUUM PUMPS, SHOVELS, BUCKETS OR OTHER MEANS AND PLACED IN DRUMS OR OTHER SUITABLE CONTAINERS.
WASTE DISPOSAL METHOD	ALL DISPOSALS MUST COMPLY WITH FEDERAL, STATE, AND LOCAL REGULATIONS. THE MATERIAL, IF SPILLED OR DISCARDED, MAY BE A REGULATED WASTE. REFER TO STATE AND LOCAL REGULATIONS. CAUTION! IF REGULATED SOLVENTS ARE USED TO CLEAN UP SPILLED MATERIAL, THE RESULTING WASTE MIXTURE MAY BE REGULATED. DEPARTMENT OF TRANSPORTATION (DOT) REGULATIONS MAY APPLY FOR TRANSPORTING THIS MATERIAL WHEN SPILLED. WASTE MATERIAL MAY BE LANDFILLED OR INCINERATED AT AN APPROVED FACILITY. MATERIALS SHOULD BE RECYCLED IF POSSIBLE.

SECTION 9 - SPECIAL PRECAUTIONS/ADDITIONAL INFORMATION	
HANDLING AND STORAGE REQUIREMENTS	DO NOT TRANSFER TO UNMARKED CONTAINERS. STORE IN CLOSED CONTAINERS AWAY FROM HEAT, SPARKS, OPEN FLAME, OR OXIDIZING MATERIALS. THIS PRODUCT IS NOT CLASSIFIED AS HAZARDOUS UNDER DOT REGULATIONS. FIRE EXTINGUISHERS SHOULD BE KEPT READILY AVAILABLE. SEE NFPA 30 AND OSHA 1910.106 FLAMMABLE AND COMBUSTIBLE LIQUIDS.
ADDITIONAL INFORMATION	THIS PRODUCT IS NOT KNOWN TO CONTAIN ANY SARA TITLE III, SECTION 313 REPORTABLE CHEMICALS, AT OR GREATER THAN 1.0% (0.1% FOR CARCINOGENS) A COMPONENT OF THIS PRODUCT IS ON THE TOXIC SUBSTANCES CONTROL ACT (TSCA) INVENTORY.

*NA=NOT APPLICABLE **ND=NOT DETERMINED

Established in 1981 megaloid laboratories limited
2221 Ninth Line | Oakville, ON L6H 7G7
Phone: 905-337-7411 | Fax: 905-337-1686
megaloid.ca

Safety Data Sheet

1. PRODUCT IDENTIFICATION

Name **Trichloroethylene**
Synonyms **1,1,2-trichloroethylene, acetylene trichloride, TCE & trade names**
CAS# **79-01-6**
Europe EC# **201-167-4**
Product Uses **cleaning solvent for vapour degreasing**

EMERGENCY INFORMATION
Canada **Call CANUTEC (collect)** **(613) 996-6666**
U.S.A. **Call CHEMTREC** **(800) 424-9300**

2. HAZARDS

GHS Class (Category)	***skin irritant (2)***	***eye irritant (2)***	***STOT (3)***	***carcinogen (1B)***	***aquatic chronic (2)***
Signal Words	***WARNING***	***WARNING***	***WARNING***	***DANGER***	***no Signal Word***
Hazard Statements	*causes skin irritation (H315)*	*causes serious eye irritation (H319)*	*may cause drowsiness or dizziness (H336)*	*may cause cancer (H350)*	*toxic to aquatic life with long-lasting effects (H411)*

GHS Precautionary Statements for Labelling

P261 P271 **Avoid breathing vapour. Use only in a well ventilated area**
P262 P264 **Do not get in eyes, on skin or on clothing. Wash thoroughly after handling.**
P270 **Do not eat, drink or smoke when using this product.**
P280 **Wear eye protection, protective gloves and clothing of butyl or "Viton".**
P273 P391 **Avoid release to the environment. Collect spillage.**

Canada – WHMIS Key: **D 1B, D 2A, D 2B**
B 2 *– Flash Point <38°C,* ***B 3*** *– Flash Point >38°C & <93°C*
D 1 *– Immediately Toxic,* ***D 2*** *– Chronic Toxicity*
C *– Oxidising Substance,* ***E*** *– Corrosive,* ***F*** *– Reactive Substance*

3. COMPOSITION

	%	TWAEV / TLV ppm / mg/m^3	LD_{50} (mg/kg) ORAL	LD_{50} (mg/kg) SKIN	LC_{50} ppm INHALATION
1,1,2-trichloroethylene	100%	10 / 55	2400	29,280	7175

4. FIRST AID

SKIN: Wash with soap & plenty of water. Remove contaminated clothing and do not reuse until thoroughly laundered.
EYES: Wash eyes with plenty of water, holding eyelids open. Seek medical assistance promptly if irritation persists.
INHALATION: Remove from contaminated area promptly. ***CAUTION: Rescuer must not endanger himself!*** If breathing stops, administer artificial respiration and seek medical aid promptly.
INGESTION: Give plenty of water to dilute product. Do not induce vomiting (NOTE below). Keep victim quiet. If vomiting occurs, lower victimôs head below hips to prevent inhalation of vomited material. Seek medical help promptly.

Inadvertent inhalation of vomited material may seriously damage the lungs. The danger of this is greater than the risk of poisoning through absorption of this relatively low-toxicity substance. The stomach should only be emptied under medical supervision, and after the installation of an airway to protect the lungs.

Please ensure that this SDS is given to, and explained to people using this product.

5. FIRE FIGHTING & FLAMMABILITY

Flash Point	will not flash[1]
Autoignition Temperature	410°C / 770°F[1]
Flammable Limits	8% ï 50% ï *only burns in continuous contact with ignition source*
Combustion Products	hydrogen chloride & chlorine (*both corrosive*), plus phosgene (*highly toxic*)
Firefighting Precautions	as for substances sustaining fire; firefighters must wear SCBA
Static Discharge	will accumulate a static charge, but cannot be ignited by a spark

NOTE: *Trichloroethylene may ignite in the presence of a welding torch – and then produce highly hazardous vapours.*

6. ACCIDENTAL RELEASE MEASURES

Leak Precaution	dyke to control spillage; dyke must be able to contain the entire volume of a bulk storage tank
Handling Spill	ventilate contaminated area; recover free liquid with suitable pumps; absorb residue on an inert sorbent, sweep shovel & store in closed containers for recycling or disposal

7. HANDLING & STORAGE

Store in a cool environment, away from substances named in Part 10 (below).

Avoid breathing product vapour. Product should be used in equipment designed for the purpose (eg: vapour degreaser) Use with adequate ventilation. If dealing with a spill, and ventilation is impossible or impractical, wear a suitable respirator (see Part 8). ***Do not routinely wear a respirator for handling this product! Effective ventilation or engineering control of vapour is the ONLY acceptable way to protect people working with this product.***

When transferring product, if there is any danger of contact, wear appropriate protective clothing.

Never cut, drill, weld or grind on or near this container. Avoid contact with skin and wash work clothes frequently. An eye bath and safety shower must be available near the workplace.

NOTE: *Although trichloroethylene is hard to ignite, fire can convert vapours into highly toxic, corrosive gases – Part 5, above.*

8. EXPOSURE CONTROL & PERSONAL PROTECTION

Ontario TWAEV	10ppm / 55mg/m^3	Ontario STEV	25ppm / 135mg/m^3
ACGIH TLV	10ppm / 55mg/m^3	ACGIH STEL	25ppm / 135mg/m^3
OSHA PEL	50ppm / 270mg/m^3	OSHA STEL	200ppm / 1080mg/m^3

Ventilation	product should only be used in specially designed equipment (eg: vapour degreaser); mechanical ventilation should not be required so long as the equipment is working properly; ***using this product in open air and relying on mechanical ventilation is NOT ACCEPTABLE****;* a respirator with organic vapour cartridge should be available for escape purposes, should vapour containment fail (*always store respirators in airtight containers [eg: "Tupperware"] to maintain cartridge "freshness"*)
Hands	ñVitonò gloves ï *other types also protect, always confirm suitability with supplier*
Eyes	safety glasses with side shields or chemical goggles – *always protect eyes!*
Clothing	impermeable (hands, above) apron, boots, long sleeves, if splashing is anticipated

9. PHYSICAL PROPERTIES

Odour & Appearance	clear, colourless, liquid with mild, sweet, *pleasant* ether odour
Odour Threshold	80ppm ï 100ppm ï *well above the TLV; hazardous below odour threshold!*
Vapour Pressure	60mmHg / 8kPa (20°C/ 68°F); also 74.5mmHg / 9.9kPa (25°C / 77°F)[1]
Evaporation Rate (*Butyl Acetate = 1*)	4.5-4.9
Vapour Density (air = 1)	4.5
Boiling Point	87°C / 189°F
Freezing Point	-73°C / -99°F; also -85°C / -121°F[1]
Specific Gravity	1.46 (20/20°C)
Water Solubility	1.1 grams/litre (20°C / 68°F)
- in other solvents	most organic solvents
Log $P_{O/W}$ (Octanol/H_2O partition)	2.53[1]
Viscosity	0.58centipoise (20°C / 68°F)[1]
pH	none ï *does not yield hydrogen ions in solution*
Conversion Factor	1ppm = 5.36mg/m^3
Molecular Weight	131

10. REACTIVITY

Dangerously Reactive With	strong oxidising agents or reducing agents; reactive metals (eg: Na, K, Ca, Ba)
Also Reactive With	strong alkalies forming explosive dichloroacetylene gas; copper reacts with any dichloroethylene present to form explosive acetylides; reactive with epoxides; unstabilised trichloroethylene may corrode aluminium, copper, zinc in presence of moisture
Chemical Stability	stable; will not polymerize ï except under x-ray or other radiation source, or in the presence of aluminium chloride
Decomposes in Presence of	iron, copper, zinc or aluminium at 250-600°C cause decomposition to phosgene; reactive metals cause decomposition to dichloroacetylene
Decomposition Products	apart from Hazardous Combustion Products ï dichloroacetylene
Mechanical Impact	not sensitive

11. TOXICITY

Effects, Acute Exposure

Skin Contact	severely irritating if not removed promptly; chemical burns if contact is prolonged (*>5 minutes*)
Skin Absorption	slight ï no systemic toxic effects by this route
Eye Contact	liquid severely irritating, may damage eyes; vapour irritates some above 160ppm, others at 350ppm blurred vision & other disturbances have been reported following contact with eyes
Inhalation	headache, dizzyness, drowsiness, intoxication may occur at above 350ppm; irritating above 1000ppm; high concentrations can lead to unconsciousness & death, numbness & muscle weakness also reported
Ingestion	burning sensation in mouth & throat; headache, dizzyness, drowsiness, intoxication & vomiting, followed by muscle weakness, plus possible delayed heart, kidney & liver damage
LD_{50} (oral)	4920 & 5620mg/kg (rat), 2400mg/kg (mouse), >7330mg/kg (rabbit), >5865mg/kg (cat), 5680mg/kg (dog)
LD_{50} (skin)	29,280mg/kg (rabbit)
LC_{50} (inhalation)	7175, 7440, 8450, 40,920 & 48,730ppm (mouse), 7250 & 26,170ppm (rat)

Effects, Chronic Exposure

General	prolonged or repeated exposure may cause dermatitis; neurological damage (headache, sleeplessness, mood change), plus blurred or tunnel vision may be seen; loss of sensation in hands & feet may occur
Sensitising	not a sensitiser
Carcinogen/Tumorigen	probable carcinogen ï IARC ï Group 1, ACGIH ï A2; the NTP rates trichloroethylene a carcinogen
Reproductive Effect	no known effect on humans or animals
Mutagen	mutagen in a few animal tests, but not in others[1]; not known to be a mutagen or teratogen in humans
Synergistic With	alcohol ï prior exposure to trichloroethylene followed by alcohol consumption causes upper body flush ï called ñ*degreasers flush*ò

12. ECOLOGICAL INFORMATION

Bioaccumulation	trichloroethylene metabolised & excreted (½-life ~40hr) and will not bioaccumulate
Biodegradation	biodegrades in aerobic sewage treatment facilities, but only in the presence of other carbon sources; biodegradation is much slower under anaerobic conditions
Abiotic Degradation	reacts with atmospheric hydroxyl (OH) radicals; estimated ½-life in air 5-7 days
Mobility in soil, water	shown to have moderate mobility in soil and the water column
Marine Toxicity	
LC_{50} (96 hr) Fish	28 & 63mg/litre/96hr (Jordanella floridae), 41mg/litre/96hr (Pimephelas promelas), 16mg/litre Limada limada), 52 & 99mg/litre (Cyprinodon variegatus), 45mg/litre (Lepomis macrochirus)
LC_{50} (48hr) Shrimp	58mg/litre/ (Daphnia cucullata), 2.2, 8, 21 & 42-97mg/litre (Daphnia magna) & others
EC_{50} (Algae)	450mg/litre (Scenedesmus subspicatus), 175mg/litre (Selenastrum capricornutum), 95 & 150mg/litre (Skeletonema costatum)
EC_{50} (Bacteria)	235mg/litre (Bacillus subtilis), >400mg/litre (Chilomonas paramecium), 975mg/litre (Photobacterium phosphoreum) & others

13. DISPOSAL

Waste Disposal	**do not flush to sewer**, recycle solvent if possible, may be incinerated in approved facility ***with flue gas monitoring and scrubbing*** *after mixing with a suitable flammable waste solvent*
Containers	**Drums** should be reused. Recondition and pressure test by a licensed reconditioner prior to re-use. **Pails** must be vented and thoroughly dried prior to crushing and recycling. **IBCs** (intermediate bulk containers): polyethylene bottle must be pressure tested & recertified at 30 months. Replace at 60 months (5yrs). Steel containers must be inspected, pressure tested & recertified every 5 years. ***Never cut, drill, weld or grind on or near this container, even if empty***

14. TRANSPORT CLASSIFICATION

Canada TDG	**PIN**	**UN-1710**
AND	**Shipping Name**	**trichloroethylene**
U.S.A. 49 CFR	**Class**	**6.1**
	Packing Group	**III**
Marine Pollutant		not a marine pollutant
ERAP Required		**NO**

15. REGULATIONS

Canada DSL	**on inventory**
U.S.A. TSCA	**on inventory**
Europe EINECS	**on inventory**

U.S.A. Regulations:

Immediately Dangerous to Life or Health: 1000 ppm; NIOSH considers trichloroethylene to be a potential occupational carcinogen.

Allowable Tolerances: Tolerances are established for residues of trichloroethylene resulting from its use as a solvent in the manufacture of foods as follows:

Food	Parts per million
Decaffeinated ground coffee	25
Decaffeinated soluble (instant) coffee extract	10
Spice oleoresins	30 parts per million (*provided that if residues of other chlorinated solvents are also present, the total of all residues of such solvents in spice oleoresins shall not exceed 30 parts per million*).

OSHA Standards: Permissible Exposure Limit: Table Z-2 8-hr Time Weighted Avg: 100 ppm. Permissible Exposure Limit: Table Z-2 Acceptable Ceiling Concentration: 200 ppm. Permissible Exposure Limit: Table Z-2 Acceptable maximum peak above the acceptable ceiling concentration for an 8-hour shift. Concentration: 300 ppm. Maximum Duration: 5 minutes in any 2 hours. Vacated 1989 OSHA PEL TWA 50 ppm (270 mg/cu m); STEL 200 ppm (1080 mg/cu m) is still enforced in some states.

NIOSH Recommendations: NIOSH considers trichloroethylene to be a potential occupational carcinogen. NIOSH usually recommends that occupational exposures to carcinogens be limited to the lowest feasible concentration. Recommended Exposure Limit: 60 Minute Ceiling Value: 2 ppm. /During the usage of trichloroethylene as an anesthetic agent/ Recommended Exposure Limit: 10 Hour Time-Weighted Average: 25 ppm. /During exposures to trichloroethylene other than as an anesthetic agent/

15. REGULATIONS, cont'd

Threshold Limit Values: 8 hr Time Weighted Avg (TWA): 10 ppm; 15min Short Term Exposure Limit (STEL) 25 ppm, A2: Suspected human carcinogen.

Atmospheric Standards: This action promulgates standards of performance for equipment leaks of Volatile Organic Compounds (VOC) in the Synthetic Organic Chemical Manufacturing Industry (SOCMI). The intended effect of these standards is to require all newly constructed, modified, and reconstructed SOCMI process units to use the best demonstrated system of continuous emission reduction for equipment leaks of VOC, considering costs, non air quality health and environmental impact and energy requirements. Trichloroethylene is produced, as an intermediate or a final product, by process units covered under this subpart. Listed as a hazardous air pollutant (HAP) generally known or suspected to cause serious health problems. The Clean Air Act, as amended in 1990, directs EPA to set standards requiring major sources to sharply reduce routine emissions of toxic pollutants. EPA is required to establish and phase in specific performance based standards for all air emission sources that emit one or more of the listed pollutants. Trichloroethylene is included on this list.

Federal Drinking Water Standards: Maximum contaminant level goals for organic contaminants: Trichloroethylene, MCLG: zero. Maximum contaminant levels (MCL) for organic contaminants apply to community and non-transient, non-community water systems: Trichloroethylene, MCL 0.005 mg/L. EPA 5 ug/l

State Drinking Water Standards: Florida 3 ug/l, New Jersey 1 ug/l

State Drinking Water Guidelines: Arizona 3.2 ug/l, Connecticut 5 ug/l, Maine 32 ug/l, Minnesota 5 ug/L

Clean Water Act Requirements: Toxic pollutant designated pursuant to section 307(a)(1) of the Federal Water Pollution Control Act and is subject to effluent limitations. Trichloroethylene is designated as a hazardous substance under section 311(b)(2)(A) of the Federal Water Pollution Control Act and further regulated by the Clean Water Act Amendments of 1977 and 1978. These regulations apply to discharges of this substance. This designation includes any isomers and hydrates, as well as any solutions and mixtures containing this substance.

CERCLA Reportable Quantities: Persons in charge of vessels or facilities are required to notify the National Response Center (NRC) immediately, when there is a release of this designated hazardous substance, in an amount equal to or greater than its reportable quantity of 100 lb or 45.4 kg. The toll free number of the NRC is (800) 424-8802. The rule for determining when notification is required is stated in 40 CFR 302.4 (section IV. D.3.b).

RCRA Requirements: As stipulated in 40 CFR 261.33, when trichloroethylene, as a commercial chemical product or manufacturing chemical intermediate or an off-specification commercial chemical product or a manufacturing chemical intermediate, becomes a waste, it must be managed according to Federal and/or State hazardous waste regulations. Also defined as a hazardous waste is any residue, contaminated soil, water, or other debris resulting from the cleanup of a spill, into water or on dry land, of this waste. Generators of small quantities of this waste may qualify for partial exclusion from hazardous waste regulations (40 CFR 261.5). A solid waste containing trichloroethylene may or may not become characterized as a hazardous waste when subjected to the Toxicity Characteristic Leaching Procedure listed in 40 CFR 261.24, and if so characterized, must be managed as a hazardous waste. When trichloroethylene is a spent solvent, it is classified as a hazardous waste from a nonspecific source, as stated in 40 CFR 261.31, and must be managed according to state and/or federal hazardous waste regulations.

FDA Requirements: Trichloroethylene is an indirect food additive for use as a component of adhesives. Tolerances are established for residues of trichloroethylene resulting from its use as a solvent in the manufacture of foods as follows:

Food	Parts per million
Decaffeinated ground coffee	25
Decaffeinated soluble (instant) coffee extract	10
Spice oleoresins	30 parts per million (*provided that if residues of other chlorinated solvents are also present, the total of all residues of such solvents in spice oleoresins shall not exceed 30 parts per million*).

16. OTHER INFORMATION

Prepared for Megaloid Laboratories by Peter Bursztyn, (705) 734-1577
*Data from **RTECS**, **HSDB** (Haz. Substance Data Base), **Cheminfo** (CCOHS), **IUCLID** Datasheets (ESIS – European Chem. Substance Info. System), & others.*
*Preparation Date: **May 2005** Revision Date: **June 2008, June 2011, June 2014***

European Chemicals Agency (EChA) dossier for Trichloroethylene:
http://apps.echa.europa.eu/registered/data/dossiers/DISS-9c83a2d3-4a9f-1ff5-e044-00144f67d249/DISS-9c83a2d3-4a9f-1ff5-e044-00144f67d249_DISS-9c83a2d3-4a9f-1ff5-e044-00144f67d249.html

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

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:

Flammable Liquid Category 2
Acute Toxicity (Oral) Category 4
Skin Corrosion/ Irritation Category 2
Serious Eye Damage/ Eye Irritation Category 2
Specific Target Organ Toxicity Repeated Exposure Category 2
Hazardous To The Aquatic Environment (Acute) Category 3
Aspiration Hazard Category 1

GHS Label elements:

Hazard symbols

Signal word

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 vapors and contact with skin and eyes.
Wear breathing apparatus/protective gloves/face protection.
Store in well-ventilated place.
Disposal must be in accordance with applicable federal, 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; Toluol; 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 2～4 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、CO_2、Dry chemical、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/m^3 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.
3. 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%～7.1%
Odour : pleasant aromatic petroleum odour	Vapor Pressure : 22 mmHg @20℃/68℉
Odour threshold : 0.16～37 ppm (detect) 1.9～69 ppm (recognition)	Vapor Density : 3.1 (air=1)
PH : Not available	Relative density : 0.86 (water=1)
Melting/Freezing Point : －95 ℃	Solubility in water : 54～58 mg/100 ml
Initial boiling point/boiling range : 110.6 ℃	Partition coefficient : 2.73 (n-octanol/water)
Flash point : 4.4 ℃ (closed cup)	Auto-ignition temperature : 480℃
Evaporation Rate : 2.24 (BuAc=1)	Decomposition temperature : Not available
Flammability (solid/gas) : Not available	Viscosity : 0.6 mPa.s max @20℃
Molecular Formula : $C_6H_5CH_3$	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
EC_{50} (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): 10～104 hr
Half-life (Surface water): 96～528 hr
Half-life (Ground water): 168～672 hr
Half-life (Soil): 96～528 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

US DOT	Shipping Name	Toluene	Hazard Labels	
	Hazard Class	3		
	UN Number	1294		
	Packing Group	II		
Sea(IMO/IMDG)	Shipping Name	Toluene	Hazard Labels	
	Hazard Class	3.2		
	UN Number	1294		
	Packing Group	II		
	IMDG Code Page	3285		
	MARPOL	Not a DOT "Marine Pollutant" per 49 CFR 171.8.		
Air(ICAO/IATA)	Shipping Name	Toluene	Hazard Labels	
	Hazard Class	3.2		
	Subsidiary Class	1294		
	Packing Group	II		
RID/ ADR	No information available.			
Canadian TDG	Shipping Name	Toluene	Hazard Labels	
	Hazard Class	3		
	UN Number	1294		
	Packing Group	II		
	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 Water 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, Massachusetts.

WARNING: This product contains Toluene, a chemical known to the state of California to cause birth defects or other reproductive harm.

California No Significant Risk Level: None of the chemicals in this product are listed.

European/International Regulations

European Labeling in Accordance with EC Directives

Hazard Symbols: XN F
Risk Phrases : R 10 Flammable.
R 20 Harmful by inhalation.
Safety Phrases : S 9 Keep container in a well-ventilated place.
S 16 Keep away from sources of ignition - No smoking.
S 25 Avoid contact with eyes.
S 29 Do not empty into drains.
S 33 Take precautionary measures against static discharges.

WGK (Water Danger/Protection)

CAS# 108-88-3: 2

United Kingdom 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.

CANADA

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.

Exposure 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 ppm (375 mg/m3);STEL 150 ppm; Skin OEL IN BULGARIA, COLOMBIA, JORDAN, KOREA check ACGIH TLV OEL IN NEW ZEALAND, SINGAPORE, VIETNAM check ACGI TLV

SECTION 16-OTHER INFORMATION

References and sources

1. CHEMINFO Data Bank, CCINFO CD, 2005-3
2. HAZARD TEXT Data Bank, TOMES PLUS CD, Vol.65, 2005
3. RETECS Data Bank, TOMES CPS 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. Chemwatch Data Bank, 2005-1
7. SDS, GHS in Taiwan, Council of Labor Affairs, Executive Yuan, ROC (Taiwan)

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 & Environment Protection Section, Taiwan SM Corporation Kaohsiung Plant.	

SAFETY DATA SHEET

Vinyl Chloride (Chloroethylene)

Section 1. Identification

GHS product identifier : Vinyl Chloride (Chloroethylene)

Chemical name : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

Product use : Synthetic/Analytical chemistry.

Synonym : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

SDS # : 001067

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 GASES - Category 1
GASES UNDER PRESSURE - Liquefied gas
CARCINOGENICITY - Category 1
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) (liver) - Category 2

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Extremely flammable gas.
Contains gas under pressure; may explode if heated.
May cause frostbite.
May displace oxygen and cause rapid suffocation.
May cause cancer.
May cause damage to organs through prolonged or repeated exposure. (liver)

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. Approach suspected leak area with caution.

Section 2. Hazards identification

Prevention : Never Put cylinders into unventilated areas of passenger vehicles. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required. Keep away from heat, sparks, open flames and hot surfaces. - No smoking. Do not breathe gas. Use and store only outdoors or in a well ventilated place.

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage : Store locked up. Protect from sunlight. Protect from sunlight when ambient temperature exceeds 52°C/125°F. Store in a well-ventilated place.

Disposal : Dispose of contents and container in accordance with all local, regional, national and international regulations.

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 : Substance

Chemical name : vinyl chloride

Other means of identification : chloroethylene; Ethene, chloro-; Vinyl chloride monomer; Chloroethene; Vinyl chloride, monomer; Ethene, chloro- (vinyl chloride); VCM; VC; Monochloroethylene; Monochloroethene

CAS number/other identifiers

CAS number : 75-01-4

Product code : 001067

Ingredient name	%	CAS number
vinyl chloride	100	75-01-4

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.

Skin contact : Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 4. First aid measures

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Skin contact : No known significant effects or critical hazards.

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/symptoms

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Indication of immediate medical 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 an extinguishing agent suitable for the surrounding fire.

Unsuitable extinguishing media : None known.

Specific hazards arising from the chemical : Contains gas under pressure. Extremely flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Hazardous thermal decomposition products : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide
halogenated compounds

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. 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. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

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, protective equipment and emergency procedures

For non-emergency personnel : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. 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 containment and cleaning up

Small spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.

Large spill : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. 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 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 gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. 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. 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). Store locked up. Eliminate all ignition sources. 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
vinyl chloride	**ACGIH TLV (United States, 3/2012).** TWA: 1 ppm 8 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.

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 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. 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 : Gas. [COLORLESS GAS OR LIQUID (BELOW 7 F) WITH A PLEASANT ODOR AT HIGH CONCENTRATIONS. [NOTE: SHIPPED AS A LIQUEFIED COMPRESSED GAS.]

Color : Colorless.

Molecular weight : 62.5 g/mole

Molecular formula : C2-H3-Cl

Boiling/condensation point : -13.4°C (7.9°F)

Melting/freezing point : -153.8°C (-244.8°F)

Critical temperature : 158.45°C (317.2°F)

Odor : Characteristic.

Odor threshold : Not available.

pH : Not available.

Flash point : Closed cup: -78°C (-108.4°F)

Burning time : Not applicable.

Burning rate : Not applicable.

Evaporation rate : Not available.

Flammability (solid, gas) : Not available.

Lower and upper explosive (flammable) limits : Lower: 3.8%
Upper: 29.3%

Vapor pressure : Not available.

Vapor density : 2.2 (Air = 1)

Specific Volume (ft^3/lb) : 1.0989

Gas Density (lb/ft^3) : 0.91 (20°C / 68 to °F)

Relative density : Not applicable.

Solubility : Not available.

Solubility in water : 1.1 g/l

Partition coefficient: n-octanol/water : 1.38

Auto-ignition temperature : 472°C (881.6°F)

Decomposition temperature : Not available.

SADT : Not available.

Viscosity : 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 : 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.

Section 10. Stability and reactivity

Incompatibility with various substances : Extremely 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.

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.

Classification

Product/ingredient name	OSHA	IARC	NTP
vinyl chloride	+	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
vinyl chloride	Category 2	Not determined	liver

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Inhalation : No known significant effects or critical hazards.

Section 11. Toxicological information

Skin contact : No known significant effects or critical hazards.

Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : No specific data.

Inhalation : No specific data.

Skin contact : No specific data.

Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

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 effects

Not available.

General : May cause damage to organs through prolonged or repeated exposure.

Carcinogenicity : May cause cancer. Risk of cancer depends on duration and level of exposure.

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	$LogP_{ow}$	BCF	Potential
vinyl chloride	1.38	-	low

Section 12. Ecological information

Mobility in soil

Soil/water partition coefficient (K_{OC}) : 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. 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
Vinyl chloride; Ethene, chloro-	75-01-4	Listed	U043

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1086	UN1086	UN1086	UN1086	UN1086
UN proper shipping name	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED	VINYL CHLORIDE, STABILIZED
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environment	No.	No.	No.	No.	No.
Additional information	**Reportable quantity** 1 lbs / 0.454 kg Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: 150	**Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Road or Rail Index** Forbidden	-	-	**Passenger and Cargo Aircraft** Quantity limitation: 0 Forbidden **Cargo Aircraft Only** Quantity limitation: 150 kg

Section 14. Transport information

	kg **Special provisions** 21, B44, T50				

"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 to Annex II of MARPOL 73/78 and the IBC Code : Not available.

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: vinyl chloride

Clean Air Act (CAA) 112 regulated flammable substances: vinyl chloride

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

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Sudden release of pressure
Delayed (chronic) health hazard

Composition/information on ingredients

Name	%	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
vinyl chloride	100	Yes.	Yes.	No.	No.	Yes.

SARA 313

Section 15. Regulatory information

	Product name	CAS number	%
Form R - Reporting requirements	vinyl chloride	75-01-4	100
Supplier notification	vinyl chloride	75-01-4	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.

Ingredient name	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
vinyl chloride	Yes.	No.	Yes.	No.

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): This material is listed or exempted.
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

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

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.
Class B-1: Flammable gas.
Class D-2A: Material causing other toxic effects (Very toxic).
Class D-2B: Material causing other toxic effects (Toxic).
Class F: Dangerously reactive material.

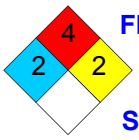
Hazardous Material Information System (U.S.A.)

Health	*	1
Flammability		4
Physical hazards		2

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.)



Flammability
Health
Instability/Reactivity
Special

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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.

History

Date of printing : 10/16/2014.

Date of issue/Date of revision : 10/16/2014.

Date of previous issue : 10/13/2014.

Version : 0.03

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 = 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

Section 16. Other information

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.

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.

SAFETY DATA SHEET

Xylene

Section 1. Identification

GHS product identifier : Xylene

Chemical name : Xylene

Synonyms : Xylol; Mixed Xylenes; Xylene Isomers and Ethylbenzene; Dimethylbenzenes and Ethylbenzene; Industrial-grade Xylene (meets ASTM D-364 Specifications); Nitration-grade Xylene (meets ASTM D-843 Specifications); CITGO® Material Code: 07306

Code : 07306

Supplier's details : CITGO Petroleum Corporation
P.O. Box 4689
Houston, TX 77210
sdsvend@citgo.com

Emergency telephone number : Technical Contact: (832) 486-4000
Medical Emergency: (832) 486-4700
CHEMTREC Emergency: (800) 424-9300
(United States Only)

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 3
ACUTE TOXICITY: INHALATION - Category 4
SKIN CORROSION/IRRITATION - Category 2
SERIOUS EYE DAMAGE/ EYE IRRITATION - Category 2A
CARCINOGENICITY: INHALATION - Category 2
SPECIFIC TARGET ORGAN TOXICITY (SINGLE EXPOSURE) [Respiratory tract irritation] - Category 3
SPECIFIC TARGET ORGAN TOXICITY (REPEATED EXPOSURE) [ears] - Category 2
ASPIRATION HAZARD - Category 1

GHS label elements

Hazard pictograms :

Signal word : Danger

Hazard statements : Flammable liquid and vapor.
Harmful if inhaled.
Causes serious eye irritation.
Causes skin irritation.
Suspected of causing cancer if inhaled.
May be fatal if swallowed and enters airways.
May cause respiratory irritation.
May cause damage to organs through prolonged or repeated exposure. (ears)

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. 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. Use only outdoors or in a well-ventilated area. Do not breathe vapor. Wash hands thoroughly after handling.

Section 2. Hazards identification

Response : Get medical attention if you feel unwell. IF exposed or concerned: Get medical attention. IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER or physician if you feel unwell. IF SWALLOWED: Immediately call a POISON CENTER or physician. Do NOT induce vomiting. 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.

Supplemental label elements : Avoid contact with skin and clothing. Wash thoroughly after handling.

Hazards not otherwise classified : Prolonged or repeated contact may dry skin and cause irritation.

Section 3. Composition/information on ingredients

Substance/mixture : Substance

Chemical name : Xylene

Other means of identification : Xylol; Mixed Xylenes; Xylene Isomers and Ethylbenzene; Dimethylbenzenes and Ethylbenzene; Industrial-grade Xylene (meets ASTM D-364 Specifications); Nitration-grade Xylene (meets ASTM D-843 Specifications); CITGO® Material Code: 07306

CAS number/other identifiers

CAS number : 1330-20-7

Ingredient name	%	CAS number
Xylenes, mixed isomers	60 - 100	1330-20-7
Ethylbenzene	10 - 30	100-41-4
Cumene	0.1 - 1	98-82-8

* = Various ** = Mixture *** = Proprietary

Any concentration shown as a range is to protect confidentiality or is due to process variation.

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 it is suspected that gas or vapor is still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus. 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 necessary, call a poison center or physician. 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 : Wash skin thoroughly with soap and water or use recognized skin cleanser. Remove contaminated clothing and shoes. Continue to rinse for at least 10 minutes. Get medical attention. Wash clothing before reuse. Clean shoes thoroughly before reuse.

Section 4. First aid measures

Ingestion : Get medical attention immediately. Call a poison center or physician. Wash out mouth with water. Remove dentures if any. Remove victim to fresh air and keep at rest in a position comfortable for breathing. Aspiration hazard if swallowed. Can enter lungs and cause damage. Do not induce vomiting. If vomiting occurs, the head should be kept low so that vomit does not enter the lungs. 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

Potential acute health effects

Eye contact : Causes eye irritation. Causes serious eye irritation.

Inhalation : Harmful if inhaled. May cause respiratory irritation.

Skin contact : Causes skin irritation. Defatting to the skin.

Ingestion : May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Over-exposure signs/symptoms

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing

Skin contact : Adverse symptoms may include the following:
irritation
redness
dryness
cracking

Ingestion : Adverse symptoms may include the following:
nausea or vomiting

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician : If ingested, this material presents a significant aspiration and chemical pneumonitis hazard. Induction of emesis is not recommended. Consider activated charcoal and/or gastric lavage. 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.

Specific treatments : Treat symptomatically and supportively.

Protection of first-aiders : No action shall be taken involving any personal risk or without suitable training. If it is suspected that gas or vapor is 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.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Specific hazards arising from the chemical : 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. Fire water contaminated with this material must be contained and prevented from being discharged to any waterway, sewer or drain.

Extinguishing media

Section 5. Fire-fighting measures

Suitable extinguishing media : Use caution when applying carbon dioxide in confined spaces. SMALL FIRE: Steam, CO_2, dry chemical or inert gas (e.g., nitrogen). LARGE FIRE: Use foam, water fog or water spray. Water fog and spray are effective in cooling containers and adjacent structures. However, water can cause frothing and/or may not extinguish the fire. Water can be used to cool the external walls of vessels to prevent excessive pressure, ignition or explosion.

Unsuitable extinguishing media : Do not use water jet.

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, 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. 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 specialized 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). Water polluting material. May be harmful to the environment if released in large quantities.

Methods and materials for containment and cleaning up

Small spill : Stop leak if without risk. Move containers from spill area. Use spark-proof tools and explosion-proof equipment. Absorb with an inert 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 information and Section 13 for waste disposal.

Section 7. Handling and storage

Precautions for safe handling

Section 7. Handling and storage

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 swallow. Avoid release to the environment. 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. Non equilibrium conditions may increase the fire hazard associated with this product. Always bond receiving containers to the fill pipe before and during loading. Always confirm that receiving container is properly grounded. Bonding and grounding alone may be inadequate to eliminate fire and explosion hazards. Carefully review operations that may increase the risks such as tank and container filling, tank cleaning, sampling, gauging, loading, filtering, mixing, agitation, etc. In addition to bonding and grounding, efforts to mitigate the hazards may include, but are not limited to, ventilation, inerting and/or reduction of transfer velocities. Always keep nozzle in contact with the container throughout the loading process. Do NOT fill any portable container in or on a vehicle.

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.

Bulk Storage Conditions: Maintain all storage tanks in accordance with applicable regulations. Use necessary controls to monitor tank inventories. Inspect all storage tanks on a periodic basis. Test tanks and associated piping for tightness. Maintain the automatic leak detection devices to assure proper working condition.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Xylenes, mixed isomers	**ACGIH TLV (United States, 4/2014).** TWA: 100 ppm 8 hours. TWA: 434 mg/m³ 8 hours. STEL: 150 ppm 15 minutes. STEL: 651 mg/m³ 15 minutes. **OSHA PEL (United States, 2/2013).** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
Ethylbenzene	**ACGIH TLV (United States, 4/2014).** TWA: 20 ppm 8 hours. **OSHA PEL (United States, 2/2013).** TWA: 100 ppm 8 hours. TWA: 435 mg/m³ 8 hours.
Cumene	**ACGIH TLV (United States, 4/2014).** TWA: 50 ppm 8 hours. **OSHA PEL (United States, 2/2013). Absorbed through**

Section 8. Exposure controls/personal protection

	skin. TWA: 50 ppm 8 hours. TWA: 245 mg/m³ 8 hours.
Xylenes, mixed (parent)	**ACGIH TLV (United States)** 6 ppm (25 mg/m³) 8 hour(s) Notes: The TLV for the hydrocarbon solvent is based on the procedure described in Appendix H ("Reciprocal Calculations Method for Certain Refined Hydrocarbon Solvent Vapors") of the ACGIH TLVs ® and BEIs® guidelines. The GGVmixture (ACGIH TLV) is based on Column B (McKee et al., 2005) of Table 1 ("Group Guidance Values") of Appendix H.

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, vapor controls, 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 glasses equipped with side shields are recommended as minimum protection in industrial settings. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: chemical splash goggles. 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 inhalation hazards exist, a full-face respirator may be required instead.

Skin protection

Hand protection : Avoid skin contact with liquid. Chemical-resistant gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary. Recommended: Heavy duty, industrial grade chemically resistant gloves constructed of nitrile, neoprene, polyethylene, fluoroelastomer rubber or polyvinyl chloride as approved by glove manufacturer. 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. Leather gloves are not protective for liquid contact.

Body protection : Avoid skin contact with liquid. 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 : Avoid skin contact with liquid. 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. Leather boots are not protective for liquid contact.

Respiratory protection : Avoid inhalation of gases, vapors, mists or dusts. Use a properly fitted, air-purifying or supplied-air 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. If an air purifying respirator is appropriate, use one equipped with cartridges rated for organic vapors.

Section 9. Physical and chemical properties

Physical state : Liquid.

Color : Transparent, colorless.

Odor : Sweet, pungent aromatic hydrocarbon.

pH : Not available.

Melting point : -48°C (-54.4°F)

Boiling point/boiling range : 138°C (280.4°F)

Flash point : Closed cup: 27°C (81°F)(Typical)

Evaporation rate : 0.8 (n-butyl acetate. = 1)

Lower and upper explosive (flammable) limits : Lower: 1%
Upper: 7%

Vapor pressure : 0.93 kPa (7 mm Hg) [room temperature]

Vapor density : 3.7 [Air = 1]

Relative density : 0.87

Density lbs/gal : 7.25 lbs/gal

Gravity, °API : Estimated 31 @ 60 F

Solubility : Very slightly soluble in the following materials: cold water.

Auto-ignition temperature : 432°C (809.6°F)

Section 10. Stability and reactivity

Reactivity : Not expected to be Explosive, Self-Reactive, Self-Heating, or an Organic Peroxide under US GHS Definition(s).

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. Do not store with strong oxidizing agents.

Incompatible materials : 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.

Section 11. Toxicological information

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Xylenes, mixed isomers	LC50 Inhalation Vapor	Rat	5000 ppm	4 hours
	LC50 Inhalation Vapor	Rat	6700 ppm	4 hours
	LD50 Oral	Mouse	2119 mg/kg	-
	LD50 Oral	Rat	4300 mg/kg	-
	LD50 Oral	Rat	4300 mg/kg	-
Ethylbenzene	LD50 Dermal	Rabbit	>5000 mg/kg	-
	LD50 Oral	Rat	3500 mg/kg	-
Cumene	LC50 Inhalation Vapor	Mouse	10 g/m³	7 hours
	LD50 Dermal	Rabbit	12300 uL/kg	-
	LD50 Oral	Rat	2.9 g/kg	-
	LD50 Oral	Rat	4000 mg/kg	-

Section 11. Toxicological information

Conclusion/Summary : **Xylenes, mixed isomers**: Overexposure to xylene may cause upper respiratory tract irritation, headache, cyanosis, blood serum changes, CNS 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 over-exposure.

Irritation/Corrosion

Product/ingredient name	Result	Species	Score	Exposure	Observation
Xylenes, mixed isomers	Skin - Mild irritant	Rat	-	8 hours 60 microliters	-
	Skin - Moderate irritant	Rabbit	-	24 hours 500 milligrams	-
	Skin - Moderate irritant	Rabbit	-	100 Percent	-
Ethylbenzene	Skin - Mild irritant	Rabbit	-	24 hours 15 milligrams	-
Cumene	Eyes - Mild irritant	Rabbit	-	86 milligrams	-
	Skin - Mild irritant	Rabbit	-	24 hours 10 milligrams	-

Skin : **Xylenes, mixed isomers**: May cause skin irritation.

Eyes : **Xylenes, mixed isomers**: May cause eye irritation.

Respiratory : **Xylenes, mixed isomers**: May cause respiratory irritation.

Sensitization

Skin : No additional information.

Respiratory : No additional information.

Mutagenicity

Conclusion/Summary : No additional information.

Carcinogenicity

Conclusion/Summary : **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). Also, the incidence of tumors was 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).

Classification

Product/ingredient name	OSHA	IARC	NTP
Xylenes, mixed isomers	-	3	-
Ethylbenzene	-	2B	-
Cumene	-	2B	Reasonably anticipated to be a human carcinogen.

Reproductive toxicity

Conclusion/Summary : **Ethylbenzene**: Studies in laboratory animals indicate limited evidence of renal malformations, resorptions, and developmental delays following high levels of maternal exposure. The relevance of these findings to humans is not clear at this time.

Teratogenicity

Conclusion/Summary : No additional information.

Specific target organ toxicity (single exposure)

Name	Category	Route of exposure	Target organs
Ethylbenzene	Category 3	Not applicable.	Respiratory tract irritation
Cumene	Category 3	Not applicable.	Respiratory tract irritation

Specific target organ toxicity (repeated exposure)

Section 11. Toxicological information

Name	Category	Route of exposure	Target organs
Ethylbenzene	Category 2	Inhalation	ears

Aspiration hazard

Name	Result
Ethylbenzene	ASPIRATION HAZARD - Category 1

Information on the likely routes of exposure : Routes of entry anticipated: Dermal, Inhalation.

Potential acute health effects

Eye contact : Causes eye irritation. Causes serious eye irritation.

Inhalation : Harmful if inhaled. May cause respiratory irritation.

Skin contact : Causes skin irritation. Defatting to the skin.

Ingestion : May be fatal if swallowed and enters airways. Irritating to mouth, throat and stomach.

Symptoms related to the physical, chemical and toxicological characteristics

Eye contact : Adverse symptoms may include the following:
pain or irritation
watering
redness

Inhalation : Adverse symptoms may include the following:
respiratory tract irritation
coughing

Skin contact : Adverse symptoms may include the following:
irritation
redness
dryness
cracking

Ingestion : Adverse symptoms may include the following:
nausea or vomiting

Potential chronic health effects

General : May cause damage to organs through prolonged or repeated exposure. Prolonged or repeated contact can defat the skin and lead to irritation, cracking and/or dermatitis.

Carcinogenicity : Suspected of causing cancer if inhaled. Risk of cancer depends on duration and level of exposure.

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.

Section 12. Ecological information

Toxicity

Section 12. Ecological information

Product/ingredient name	Result	Species	Exposure
Xylenes, mixed isomers	Acute EC50 90 mg/l Fresh water	Crustaceans - Cypris subglobosa	48 hours
	Acute LC50 8.5 ppm Marine water	Crustaceans - Palaemonetes pugio - Adult	48 hours
	Acute LC50 8500 µg/l Marine water	Crustaceans - Palaemonetes pugio	48 hours
	Acute LC50 15700 µg/l Fresh water	Fish - Lepomis macrochirus - Juvenile (Fledgling, Hatchling, Weanling)	96 hours
	Acute LC50 19000 µg/l Fresh water	Fish - Lepomis macrochirus	96 hours
	Acute LC50 13400 µg/l Fresh water	Fish - Pimephales promelas	96 hours
	Acute LC50 16940 µg/l Fresh water	Fish - Carassius auratus	96 hours
Ethylbenzene	Acute EC50 4600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 3600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
	Acute EC50 2930 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 5200 µg/l Marine water	Crustaceans - Americamysis bahia	48 hours
	Acute LC50 4200 µg/l Fresh water	Fish - Oncorhynchus mykiss	96 hours
	Chronic NOEC 1000 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	96 hours
Cumene	Acute EC50 2600 µg/l Fresh water	Algae - Pseudokirchneriella subcapitata	72 hours
	Acute EC50 7400 µg/l Fresh water	Crustaceans - Artemia sp. - Nauplii	48 hours
	Acute EC50 10600 µg/l Fresh water	Daphnia - Daphnia magna - Neonate	48 hours
	Acute LC50 2700 µg/l Fresh water	Fish - Oncorhynchus mykiss	96 hours

Conclusion/Summary : Not available.

Persistence and degradability

Conclusion/Summary : Not available.

Bioaccumulative potential

Product/ingredient name	$LogP_{ow}$	BCF	Potential
Xylenes, mixed isomers	3.12	8.1 to 25.9	low
Ethylbenzene	3.6	-	low
Cumene	3.55	94.69	low

Mobility in soil

Soil/water partition coefficient (K_{OC}) : 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. 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

Section 13. Disposal considerations

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.

RCRA classification : D001, D018

United States - RCRA Toxic hazardous waste "U" List

Ingredient	CAS #	Status	Reference number
Xylene	1330-20-7	Listed	U239

Section 14. Transport information

	DOT Classification	IMDG	IATA
UN number	UN1307	UN1307	UN1307
UN proper shipping name	RQ, Xylenes, 3, UN 1307, PG III	RQ, Xylenes, 3, UN 1307, PG III	RQ, Xylenes, 3, UN 1307, PG III
Transport hazard class(es)	3 	3 	3 
Packing group	III	III	III
Environmental hazards	No.	No.	No.
Additional information	**Reportable quantity** 125 lbs / 56.749 kg [17.232 gal / 65.229 L] Package sizes shipped in quantities less than the product reportable quantity are not subject to the RQ (reportable quantity) transportation requirements. **Packaging instruction** **Passenger aircraft** Quantity limitation: 60 L **Cargo aircraft** Quantity limitation: 220 L	-	**Passenger and Cargo Aircraft** Quantity limitation: 60 L **Cargo Aircraft Only**Quantity limitation: 220 L

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.

Section 15. Regulatory information

U.S. Federal regulations : **United States inventory (TSCA 8b)**: All components are listed or exempted.

Clean Water Act (CWA) 307: Ethylbenzene; Toluene; Benzene; Naphthalene

Clean Water Act (CWA) 311: Xylene

This material is classified as an oil under Section 311 of the Clean Water Act (CWA) and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters must be reported to the EPA's National Response Center at (800) 424-8802.

SARA 302/304

Composition/information on ingredients

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Fire hazard
Immediate (acute) health hazard
Delayed (chronic) health hazard

Composition/information on ingredients

Name	Fire hazard	Sudden release of pressure	Reactive	Immediate (acute) health hazard	Delayed (chronic) health hazard
Xylenes, mixed isomers	Yes.	No.	No.	Yes.	Yes.
Ethylbenzene	Yes.	No.	No.	Yes.	Yes.
Cumene	Yes.	No.	No.	Yes.	Yes.

SARA 313

	Product name	CAS number	%
Form R - Reporting requirements	Xylenes, mixed isomers Ethylbenzene	1330-20-7 100-41-4	<90 <30
Supplier notification	Xylenes, mixed isomers Ethylbenzene	1330-20-7 100-41-4	<90 <30

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 : The following components are listed: XYLENE

New York : The following components are listed: Xylene (mixed)

New Jersey : The following components are listed: XYLENES; BENZENE, DIMETHYL-

Pennsylvania : The following components are listed: BENZENE, DIMETHYL-

California Prop. 65

WARNING: This product contains a chemical known to the State of California to cause cancer.
WARNING: This product contains less than 1% of a chemical known to the State of California to cause birth defects or other reproductive harm.

Ingredient name	%	Cancer	Reproductive	No significant risk level	Maximum acceptable dosage level
Ethylbenzene	<30	Yes.	No.	41 µg/day (ingestion) 54 µg/day (inhalation)	No.
Cumene	<1	Yes.	No.	No.	No.
Toluene	<0.1	No.	Yes.	No.	7000 µg/day (ingestion)
Benzene	<0.01	Yes.	Yes.	6.4 µg/day (ingestion) 13 µg/day	24 µg/day (ingestion) 49 µg/day (inhalation)

Section 15. Regulatory information

Naphthalene	<0.0001	Yes.	No.	(inhalation) Yes.	No.

International regulations

International lists : **Australia inventory (AICS)**: All components are listed or exempted.
China inventory (IECSC): All components are listed or exempted.
Japan inventory: All components are listed or exempted.
Korea inventory: All components are listed or exempted.
Malaysia Inventory (EHS Register): All components are listed or exempted.
New Zealand Inventory of Chemicals (NZIoC): All components are listed or exempted.
Philippines inventory (PICCS): All components are listed or exempted.
Taiwan inventory (CSNN): All components are listed or exempted.

Canada inventory : All components are listed or exempted.

EU Inventory : All components are listed or exempted.

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).

Section 16. Other information

National Fire Protection Association (U.S.A.)

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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.

History

Date of issue/Date of revision : 6/29/2015.

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 = 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 Nations

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Section 16. Other information

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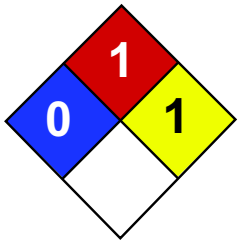

Material Safety Data Sheet
Zinc Metal MSDS

Section 1: Chemical Product and Company Identification

Product Name: Zinc Metal

Catalog Codes: SLZ1054, SLZ1159, SLZ1267, SLZ1099, SLZ1204

CAS#: 7440-66-6

RTECS: ZG8600000

TSCA: TSCA 8(b) inventory: Zinc Metal

CI#: Not applicable.

Synonym: Zinc Metal Sheets; Zinc Metal Shot; Zinc Metal Strips

Chemical Name: Zinc Metal

Chemical Formula: Zn

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
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.

Ionicity (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

APPENDIX D

HEAT AND COLD STRESS FACT SHEETS

Protecting Yourself from
Cold Stress

Workers who are exposed to extreme cold or work in cold environments may be at risk of cold stress. Extremely cold or wet weather is a dangerous situation that can cause occupational illness and injuries such as hypothermia, frostbite, trench foot, and chilblains.

Hypothermia

A condition in which the body uses up its stored energy and can no longer produce heat. Often occurs after prolonged exposure to cold temperature.

Early symptoms

- Shivering
- Fatigue
- Loss of coordination
- Confusion and disorientation

Late symptoms

- No shivering
- Blue skin
- Dilated pupils
- Slowed pulse and breathing
- Loss of consciousness

First Aid

- Request immediate medical assistance.
- Move the victim into a warm room or shelter.
- Remove wet clothing.
- Warm the center of their body first—chest, neck, head, and groin—using an electric blanket; or use skin-to-skin contact under loose, dry layers of blankets, clothing, or towels.
- If conscious, warm beverages may help increase the body temperature. Do not give alcohol.
- Once temperature has increased keep them dry and wrapped in a warm blanket, including the head and neck.
- If no pulse, begin CPR.

Frostbite

An injury to the body that is caused by freezing, which most often affects the nose, ears, cheeks, chin, fingers, or toes.

Symptoms

- Reduced blood flow to hands and feet
- Numbness
- Aching
- Tingling or stinging
- Bluish or pale, waxy skin

First Aid

- Get into a warm room as soon as possible.
- Unless necessary, do not walk on frostbitten feet or toes.
- Immerse the affected area in warm (not hot) water, or warm the affected area using body heat. Do not use a heating pad, fireplace, or radiator for warming.
- Do not massage the frostbitten area; doing so may cause more damage.

Trench Foot

An injury of the feet resulting from prolonged exposure to wet and cold conditions that can occur at temperatures as high as 60 °F if the feet are constantly wet.

Symptoms

- Reddening of the skin
- Numbness
- Leg cramps
- Swelling
- Tingling pain
- Blisters or ulcers
- Bleeding under the skin
- Gangrene (foot may turn dark purple, blue, or gray)

First Aid

- Remove shoes/boots and wet socks.
- Dry feet.
- Avoid walking on feet, as this may cause tissue damage.

Chilblains

Ulcers formed by damaged small blood vessels in the skin, caused by the repeated exposure of skin to temperatures just above freezing to as high as 60 °F.

Symptoms

- Redness
- Itching
- Possible blistering
- Inflammation
- Possible ulceration in severe cases

First Aid

- Avoid scratching.
- Slowly warm the skin.
- Use corticosteroid creams to relieve itching and swelling
- Keep blisters and ulcers clean and covered.

Protect Yourself

- Monitor your physical condition and that of your coworkers.
- Wear appropriate clothing.
  - Wear several layers of loose clothing for insulation.
  - Tight clothing reduces blood circulation to the extremities.
- Be aware that some clothing may restrict movement resulting in a hazardous situation.
- Protect the ears, face, hands and feet in extremely cold or wet weather.
  - Boots should be waterproof and insulated.
  - Wear a hat to reduce the loss of body heat from your head.
- Move into warm locations during breaks; limit the amount of time outside.
- Carry extra socks, gloves, hats, jacket, blankets, a change of clothes and a thermos of hot liquid.
- Include chemical hot packs in your first aid kit.
- Avoid touching cold metal surfaces with bare skin.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

www.cdc.gov/niosh/topics/outdoor/

DHHS (NIOSH) Publication No. 2010–115

Telephone: 1–800–CDC–INFO
TTY: 1–888–232–6348
E-mail: cdcinfo@cdc.gov

NIOSH

Fast Facts

Protecting Yourself from

Heat Stress

Heat stress, from exertion or hot environments, places workers at risk for illnesses such as heat stroke, heat exhaustion, or heat cramps.

Heat Stroke

A condition that occurs when the body becomes unable to control its temperature, and can cause death or permanent disability.

Symptoms

- High body temperature
- Confusion
- Loss of coordination
- Hot, dry skin or profuse sweating
- Throbbing headache
- Seizures, coma

First Aid

- Request immediate medical assistance.
- Move the worker to a cool, shaded area.
- Remove excess clothing and apply cool water to their body.

Heat Exhaustion

The body's response to an excessive loss of water and salt, usually through sweating.

Symptoms

- Rapid heart beat
- Heavy sweating
- Extreme weakness or fatigue
- Dizziness
- Nausea, vomiting
- Irritability
- Fast, shallow breathing
- Slightly elevated body temperature

First Aid

- Rest in a cool area.
- Drink plenty of water or other cool beverages.
- Take a cool shower, bath, or sponge bath.

Heat Cramps

Affect workers who sweat a lot during strenuous activity. Sweating depletes the body's salt and moisture levels.

Symptoms

- Muscle cramps, pain, or spasms in the abdomen, arms or legs

First Aid

- Stop all activity, and sit in a cool place.
- Drink clear juice or a sports beverage, or drink water with food.
  - Avoid salt tablets.
- Do not return to strenuous work for a few hours after the cramps subside.
- Seek medical attention if you have the following: heart problems, are on a low-sodium diet, or if the cramps do not subside within one hour.

Protect Yourself

Avoid heavy exertion, extreme heat, sun exposure, and high humidity when possible. When these cannot be avoided, take the following preventative steps:

- Monitor your physical condition and that of your coworkers for signs or symptoms of heat illnesses.
- Wear light-colored, loose-fitting, breathable clothing such as cotton.
  - Avoid non-breathable synthetic clothing.
- Gradually build up to heavy work.
- Schedule heavy work during the coolest parts of day.
- Take more breaks when doing heavier work, and in high heat and humidity.
  - Take breaks in the shade or a cool area.
- Drink water frequently. Drink enough water that you never become thirsty.
- Be aware that protective clothing or personal protective equipment may increase the risk of heat-related illnesses.

DEPARTMENT OF HEALTH AND HUMAN SERVICES
Centers for Disease Control and Prevention
National Institute for Occupational Safety and Health

www.cdc.gov/niosh/topics/outdoor/

DHHS (NIOSH) Publication No. 2010–114

Telephone: 1–800–CDC–INFO
TTY: 1–888–232–6348
E-mail: cdcinfo@cdc.gov

APPENDIX E

JOBSITE SAFETY INSPECTION FORM

LANGAN
ENGINEERING & ENVIRONMENTAL SERVICES

Client: _____ Inspection Date: _____

Site: _____ Inspector: _____

Project Number: _____

Check one of the following: **A:** Acceptable **NA**: Not Applicable **D**: Deficiency

	A	NA	D	Remarks
1. HASP available on site for inspection?				
2. Health & Safety Compliance agreement (in HASP) appropriately signed by Langan employees and subcontractors?				
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 subcontractors?				
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. Markouts of underground utilities done prior to initiating any subsurface activities?				
20. Decontamination procedures being followed as outlined in HASP?				
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, layed 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 knowledgable 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 observed? _____

_____

_____

_____

Additional remarks _____

_____

_____

_____

Distribution: Project Manager (for information and follow-up) Name: _____
Health & Safety Officer (for corrective action) Name: _____
Health & Safety Coordinator (resource for corrective action and follow-up)

APPENDIX F

SITE SAFETY MEETING FORM

SAFETY BRIEFING

Date: _____Time: _____Leader: _____Location: _____

Work Task: _____

SAFETY TOPICS (*provide some detail of discussion points*)

Chemical Exposure Hazards and Control _____

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

Briefing Conducted By: _____

APPENDIX G

DECONTAMINATION PROCEDURES

PERSONNEL DECONTAMINATION

LEVEL A DECONTAMINATION

Station 1:	Equipment Drop	1. 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 fully-encapsulating 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:	Tank Change	4. If worker leaves Exclusion Zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, fully-encapsulating suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	SCBA Removal	6. SCBA backpack and facepiece is removed (avoid touching face with fingers). SCBA deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL B DECONTAMINATION

Station 1:	Equipment Drop	1. 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-resistant 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:	Tank Change	4. If worker leaves Exclusion Zone to change air tank, this is the last step in the decontamination procedure. Worker's air tank is exchanged, new outer gloves and boot covers donned, joints taped, and worker returns to duty.
Station 5:	Boot, Gloves and Outer Garment Removal	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	SCBA Removal	6. SCBA backpack and facepiece is removed (avoid touching face with fingers). SCBA deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL C DECONTAMINATION

Station 1:	Equipment Drop	1. 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-resistant 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	4. 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	5. Boots, chemical-resistant splash suit, inner gloves removed and deposited in separate containers lined with plastic.
Station 6:	Facepiece Removal	6. Facepiece is removed (avoid touching face with fingers). Facepiece deposited on plastic sheets.
Station 7:	Field Wash	7. Hands and face are thoroughly washed. Shower as soon as possible.

LEVEL D DECONTAMINATION

Station 1:	Equipment Drop	1. 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-resistant 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:	Boot, Gloves and Outer Garment Removal	4. 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 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.

APPENDIX H

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.