9. Emergency Procedures

9.1 General

Prior to the start of operations, the work area will be evaluated for the potential for fire, contaminant release, or other catastrophic event. Unusual conditions or events, activities, chemicals, and conditions will be reported to the SS/HSS immediately.

The SS/HSS will establish evacuation routes and assembly areas for the site. All personnel entering the site will be informed of this route and the assembly area.

9.2 Emergency Response

If an incident occurs, the following steps will be taken:

- The SS/HSS will evaluate the incident and assess the need for assistance and/or evacuation.
- The SS/HSS will call for outside assistance as needed.
- The SS/HSS will ensure the PM is notified promptly of the incident.
- The SS/HSS will take appropriate measures to stabilize the incident scene.

9.2.1 Fire

In the case of a fire at the site, the SS/HSS will assess the situation and direct fire-fighting activities. The SS/HSS will ensure that the PM is immediately notified of any fires. Site personnel will attempt to extinguish the fire with available extinguishers, if safe to do so. In the event of a fire that site personnel are unable to safely extinguish with one fire extinguisher, the local fire department will be summoned.

9.2.2 Contaminant Release

In the event of a contaminant release, the following steps will be taken:

- Notify SS/HSS immediately.
- Evacuate immediate area of release.
- Conduct air monitoring to determine needed level of PPE.
- Don required level of PPE and prepare to implement control procedures.

The SS/HSS has the authority to commit resources as needed to contain and control released material and to prevent its spread to offsite areas.

9.3 Medical Emergency

All employee injuries must be promptly reported to the HSS/SS, who will:

- Ensure that the injured employee receives prompt first aid and medical attention.
- In emergency situations, the worker is to be transported by appropriate means to the nearest urgent care facility (normally a hospital emergency room).
- If the injured person is an ARCADIS employee, notify Pat Bullock, ARCADIS Workers Comp Administrator, at 1-720-344-3844 as soon as possible after the employee has been safely evacuated from the scene.

Emergency Care Steps

Survey the scene. Determine if it is safe to proceed. Try to determine if the conditions that caused the incident are still a threat. Protect yourself from exposure before attempting to rescue the victim.

- Do a primary survey of the victim. Check for airway obstruction, breathing, and pulse. Assess likely routes of chemical exposure by examining the eyes, mouth, nose, and skin of the victim for symptoms.
- Phone Emergency Medical Services (EMS). Give the location, telephone number used, caller's name, what happened, number of victims, victim's condition, and help being given.
- Maintain airway and perform rescue breathing as necessary.
- Perform CPR as necessary.
- Do a secondary survey of the victim. Check vital signs and do a head-to-toe exam.

Treat other conditions as necessary. If the victim can be moved, take him/her to a location away from the work area where EMS can gain access.

9.4 First Aid - General

All persons must report any injury or illness to their immediate supervisor or the SS. Trained personnel will provide first aid. Injuries and illnesses requiring medical treatment must be documented. The SS and HSS must conduct an II as soon as emergency conditions no longer exist and first aid and/or medical treatment has been

ensured. IIs must be completed and submitted to the PM within 24 hours after the incident.

If first-aid treatment is required, first aid kits are kept at the CRZ. If treatment beyond first aid is required, the injured person(s) should be transported to the medical facility. If the injured person is not ambulatory, or shows any sign of not being in a comfortable and stable condition for transport, then an ambulance/paramedics should be summoned. If there is any doubt as to the injured worker's condition, it is best to let the local paramedic or ambulance service examine and transport the worker.

9.4.1 First Aid - Inhalation

Any employee complaining of symptoms of chemical overexposure as described in Section 4, General Site Safety Procedures, will be removed from the work area and transported to the designated medical facility for examination and treatment.

9.4.2 First Aid - Ingestion

Call EMS and consult a poison control center for advice. If available, refer to the MSDS for treatment information. If the victim is unconscious, keep them on their side and clear the airway if vomiting occurs.

9.4.3 First Aid - Skin Contact

Project personnel who have had skin contact with contaminants will, unless the contact is severe, proceed through the CRZ, to the wash area. Personnel will remove any contaminated clothing, and then flush the affected area with water for at least 15 minutes. The worker should be transported to the medical facility if he/she shows any sign of skin reddening, irritation, or if he/she requests a medical examination.

9.4.4 First Aid - Eye Contact

Project personnel who have had contaminants splashed in their eyes or who have experienced eye irritation while in the EZ, must immediately proceed to the eyewash station in the CRZ. Do not decontaminate prior to using the eyewash. Remove whatever protective clothing is necessary to use the eyewash. Flush the eye with clean running water for at least 15 minutes. Arrange prompt transport to the designated medical facility.

9.5 Reporting Injuries, Illnesses, and Near Miss Incidents

Injuries and illnesses, however minor, will be reported to the SS immediately. The SS will complete an injury report and submit it to the HSM/HSO, PIC, National Fuel and the PM within 24 hours.

Near miss incidents are situations in which no injury or property damage occurred, but under slightly different circumstances an injury or property damage could have occurred. Near misses are caused by the same factors as injuries; therefore, they must be reported and investigated in the same manner. A SPSA must be done immediately after an injury, illness, near miss, or other incident to determine if it is safe to proceed with the work.

9.6 Non-Emergency, Non-Life Threatening Work Related Injury or Illness

For minor illnesses or injuries that may be work-related and are **not** life threatening or emergencies (e.g., you're in your hotel room and your lower back tightens up, earlier in the day you hand-augured 50 borings; you cut your hand in the office, put a band-aid on the cut, and go back to work, but when you get home you realize the cut is deep and is still bleeding; you hit your head on a cabinet while loading paper, and later on that day you suddenly feel dizzy.) employees will take the following steps **before** seeking medical treatment at a medical treatment facility:

As soon as possible, contact WorkCare at (00) 1-800-455-6155 (Once you've spoken with WorkCare, you can let your supervisor know).

- WorkCare will discuss the medical issues with you and provide appropriate medical guidance.

- If WorkCare feels that you should see a physician:

    - They will help you locate a physician/clinic and will contact the clinic to discuss the treatment plan. If they have a concern about the treatment plan, one of the WorkCare physicians will attempt to contact the treating physician to discuss the plan and will keep you advised.

- If WorkCare feels that first-aid/self-treatment is medically appropriate:

    - They will provide the treatment information to you and will follow up with you to determine effectiveness.

- If the medical issue persists, WorkCare will advise alternative treatment or will refer you to a physician.

- Keep your supervisor informed on what action you will be taking. If you are seen by a physician, keep them advised as to your work status and upcoming medical appointments.

If an injury or illness is life-threatening or an emergency, please seek medical attention immediately. As soon as possible, notify your supervisor.

9.7 Emergency Information

The means to summon local public response agencies such as police, fire, and ambulance will be reviewed in the daily safety meeting. These agencies are identified in Table 9-1.

Table 9-1. Emergency Contacts

Local Emergency Contacts	Telephone No.
Fire	911
Police	911
Ambulance	911
Hospital: Brooks Memorial Hospital	716.366.1111
Project Emergency Contacts	**Telephone No.**
ARCADIS Project Manager: Scott Powlin	315.446.9120, ext. 19456
ARCADIS Site Supervisor: TBD	315.446.9120
ARCADIS Health and Safety Supervisor: TBD	315.446.9120
National Fuels: Tanya Alexander	716.857.7410
NYSDEC: William Ottaway	518.402.9686

9.7.1 Directions to Hospital (Non-Emergency)

Total Time: 1 minute Total Distance: 0.51 miles

A: 31 W 2nd St, Dunkirk, NY 14048-1503

START	1: Start out going EAST on W 2ND ST toward EAGLE ST.	0.1 mi
	2: Turn RIGHT onto CENTRAL AVE.	0.4 mi
END	3: End at 529 Central Ave Dunkirk, NY 14048	

B: Brooks Memorial Hospital: 529 Central Ave, Dunkirk, NY 14048, (716) 366-1111

Total Time: 1 minute Total Distance: 0.51 miles

ARCADIS

Appendix C
Health and Safety Plan

ATTACHMENTS

ARCADIS

Attachment A

Material Safety Data Sheets

MATERIAL SAFETY DATA SHEET

ScholAR™ Chemistry

5100 W. Henrietta Rd.
West Henrietta, NY 14586
TEL: (866) 260-0501

MSDS No. 9609604 9609706
Effective Date: December 11, 2002

SECTION I NAME

24 HOUR EMERGENCY ASSISTANCE

416-984-3000

Product	Aniline
Chemical Synonyms	N/A
Formula	$C_2H_5NH_2$
CAS No.	62-53-3

NFPA: 2 / 3 / 0

Health	3
Flammability	2
Reactivity	2

HAZARD RATING WHMIS

LEAST	SLIGHT	MODERATE	HIGH	EXTREME
0	1	2	3	4

SECTION II DANGEROUS INGREDIENTS

Name	%	TLV Units
Aniline	100%	N/A
DANGER! POISON!		

SECTION III PHYSICAL DATA

Melting Point (°C)	-6.2°C	Specific Gravity (H_2O = 1)	1.022
Boiling Point (°C)	184°C	Percent Volatile by Volume (%)	100%
Vapor Pressure (mm Hg)	0.5 mm @ 20°C	Evaporation Rate (n-Butyl acetate =1)	< 1
Vapor Density (Air=1)	3.22		
Solubility in Water	0.3 g/Lt. @ 20°c		
Appearance & Odor	Colorless oily liquid; amine odor.		

SECTION IV FIRE AND EXPLOSION HAZARD DATA

			Lower	Upper
Flash point	70°C (CC)	Flammable Limits in Air % by Volume	1.3%	20.0%

Firefighting Procedures

Use dry chemical, CO_2, alcohol foam, or water spray. In fire conditions, fire-fighters should wear an appropriate mask or a self-containing breathing apparatus.

Flammability and Explosion Hazards

Fire or excessive heat may produce hazardous decomposition products to be produced as dust or fume.

Auto-ignition temperature: 615°C

TDG **Class 6.1 Toxic substance. UN1547**

SECTION V REACTIVITY DATA

AA0359

Chemical Stability	Yes	X	If no, under what conditions?
	No		
Incompatible with Other products	Yes	X	Alkalies, acids, strong oxidizers, albumin, solutions of iron, zinc, aluminum.
	No		

Hazardous Decomposition Products	Nitrogen and carbon oxides.
Reactive under what conditions	Volatile with steam. Ignites in presence of Nitric acid or Sodium.

SECTION VI TOXICOLOGICAL PROPERTIES

Route of Entry	Ingestion. Inhalation. Skin.
TLV	TWA: 2 ppm, 7.6 mg/m^3 (skin).
Toxicity for animals	Acute oral toxicity (LD50): 250 mg/kg (Rat).
Chronic effects on humans	The substance is toxic to the blood, kidneys, lungs and liver. Repeated or prolonged exposure to the substance can produce target organs damage. Target organs: Kidneys, red blood cells, central nervous system, liver.
Acute effects on humans	Harmful if swallowed, inhaled or absorbed through skin. Contact may cause irritation to the skin and eyes. May cause cyanosis.

SECTION VII PREVENTIVE MEASURES

Waste Disposal	Discharge, treatment, or disposal may be subject to local laws. Consult your local or regional authorities.
Storage	Keep container dry. Keep in a cool place. Keep container tightly closed. Toxic materials should be stored in a separate locked safety storage cabinet or room.
Precautions	Keep away from heat. Keep away from sources of ignition. DO NOT breathe gas, fumes, vapor or spray. Do not ingest. If ingested, seek immediate medical attention.
Spill or leak	Absorb with an inert dry material and place in an appropriate waste disposal container.
Protective Clothing	Safety goggles. Lab coat. Gloves. Anit-vapor respirator.

SECTION VIII FIRST AID MEASURES

Specific first aid measures

Ingestion: Call physician or Poison Control Center immediately. Induce vomiting only if advised by the appropriate medical personnel. Eye contact: Check for and remove any contact lenses. Immediately flush eyes with running water for at least 15 minutes, keeping eyelids open. Seek medical attention. Skin contact: Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Inhalation: Move victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Allow victim to rest in a well ventilated area. Seek immediate medical attention.

SECTION IX PREPARATION OF THE MSDS

Rev. No.	Date	Approved
2	December 11, 2002	Michael Raszeja

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Benzene
MSDS 316
BEN2200

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Benzene **CAS Number:** 71-43-2
Chemical Formula: C_6H_6
Structural Chemical Formula: C_6H_6
Synonyms: (6)ANNULENE; BENZEEN; BENZEN; BENZENE; BENZIN; BENZINE; BENZOL; BENZOL 90; BENZOLE; BENZOLENE; BENZOLO; BICARBURET OF HYDROGEN; CARBON OIL; COAL NAPHTHA; CYCLOHEXATRIENE; EPA PESTICIDE CHEMICAL CODE 008801; FENZEN; MINERAL NAPHTHA; MOTOR BENZOL; NITRATION BENZENE; PHENE; PHENYL HYDRIDE; POLYSTREAM; PYROBENZOL; PYROBENZOLE
General Use: Manufacture of chemicals including styrene, dyes, and many other organic chemicals. Has been used in artificial leather, linoleum, oil cloth, airplane dopes, lacquers; as solvent for waxes, resins, oils etc.
May also be a minor component of gasoline, petrol.
Exposure should be minimized by use in closed systems.
Handling procedures and control measures should be evaluated for exposure before commencement of use in plant operations.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
benzene	71-43-2	99.9

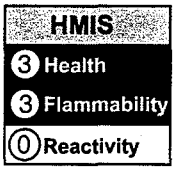
OSHA PEL
TWA: 1 ppm; 3 mg/m^3; STEL: 5 ppm; 15 mg/m^3; from Table Z-2.

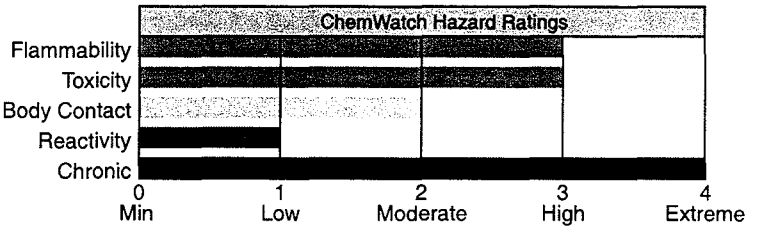
ACGIH TLV
TWA: 10 ppm; 32 mg/m^3.

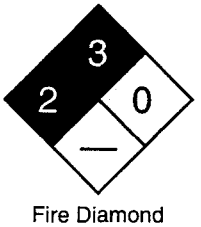
NIOSH REL
TWA: 0.1 ppm. STEL: 1 ppm.

IDLH Level
500 ppm.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sweet odor. Irritating to eyes/skin/respiratory tract. Toxic. Also causes: headache, dizziness, drowsiness. Absorbed through the skin. Chronic: dermatitis, leukemia, bone marrow damage. Carcinogen. Reproductive effects. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin contact
Target Organs: blood, central nervous system (CNS), bone marrow, eyes, upper respiratory system, skin
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract and lungs and may be harmful if inhaled. If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

Inhalation hazard is increased at higher temperatures.

The symptoms of acute exposure to high vapor concentrations include confusion, dizziness, tightening of the leg muscles and pressure over the forehead followed by a period of excitement. If exposure continues the casualty quickly becomes stupefied and lapses into a coma with narcosis.

Effects of inhalation may include nausea, vomiting headache, dizziness, drowsiness, weakness, sometimes preceded by brief periods of exhilaration, or euphoria, irritability, malaise, confusion, ataxia, staggering, weak and rapid pulse, chest pain and tightness with breathlessness, pallor, cyanosis of the lips and fingertips and tinnitus. Severe exposures may produce blurred vision, shallow, rapid breathing, delirium, cardiac arrhythmias, unconsciousness, deep anesthesia, paralysis and coma characterized by motor restlessness, tremors and hyperreflexia (occasionally preceded by convulsions). Polyneuritis and persistent nausea, anorexia, muscular weakness, headache, drowsiness, insomnia and agitation may also occur. Two-three weeks after the exposure, nervous irritability, breathlessness and unsteady gait may still persist; cardiac distress and an unusual dicoloration of the skin may be evident for up to four weeks.

Hemotoxicity is not normally a feature of acute exposures although anemia, thrombocytopenia, petechial hemorrhage, and spontaneous internal bleeding have been reported. Fatal exposures may result from asphyxia, central nervous system depression, cardiac and respiratory failure and circulatory collapse; sudden ventricular fibrillation may also be fatal.

Death may be sudden or may be delayed for 24 hours. Central nervous system, respiratory or hemorrhagic complications may occur up to five days after the exposure and may be lethal; pathological findings include respiratory inflammation with edema, and lung hemorrhage, renal congestion, cerebral edema and extensive petechial hemorrhage in the brain, pleurae, pericardium, urinary tract, mucous membrane and skin.

Exposure to toxic levels has also produced chromosome damage.

Eye: The liquid is highly discomforting to the eyes, may be harmful following absorption and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is moderately discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis. Open cuts, abraded or irritated skin should not be exposed to this material.

Toxic effects may result from skin absorption.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: The liquid is discomforting to the gastrointestinal tract and may be harmful if swallowed.

Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Class 1, Known to be a carcinogen; IARC - Group 1, Carcinogenic to humans; OSHA - Listed as a carcinogen; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class A, Human carcinogen; MAK - Class A1, Capable of inducing malignant tumors as shown by experience with humans.

Chronic Effects: Liquid is an irritant and may cause burning and blistering of skin on prolonged exposure.

Chronic exposure may cause headache, fatigue, loss of appetite and lassitude with incipient blood effects including anemia and blood changes.

Benzene is a myelotoxicant known to suppress bone-marrow cell proliferation and to induce hematologic disorders in humans and animals.

Signs of benzene-induced aplastic anemia include suppression off leukocytes (leukopenia), red cells (anemia), platelets (thromocytopenia) or all three cell types (pancytopenia). Classic symptoms include weakness, purpura, and hemorrhage. The most significant toxic effect is insidious and often irreversible injury to the blood forming tissue. Leukemia may develop.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1.Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.

2.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.

3.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.

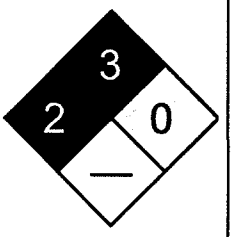
4.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.

5.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.

6.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.
Consider complete blood count. Evaluate history of exposure.

Section 5 - Fire-Fighting Measures

Flash Point: -11 °C Closed Cup
Autoignition Temperature: 562 °C
LEL: 1.3% v/v
UEL: 7.1% v/v



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Pollutant - contain spillage. Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.

Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Storage Requirements: Store in original containers in approved flame-proof area.
No smoking, bare lights, heat or ignition sources.
DO NOT store in pits, depressions, basements or areas where vapors may be trapped. Keep containers securely sealed.
Store away from incompatible materials in a cool, dry well ventilated area.
Protect containers against physical damage and check regularly for leaks.
Observe manufacturer's storing and handling recommendations.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation usually required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection. NIOSH-approved self contained breathing apparatus (SCBA) may be required in some situations.
Provide adequate ventilation in warehouse or closed storage area.
Personal Protective Clothing/Equipment
Eyes: Chemical goggles. Full face shield.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Nitrile gloves; Neoprene gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Respiratory Protection:
Exposure Range >1 to 10 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range >10 to 100 ppm: Air Purifying, Negative Pressure, Full Face
Exposure Range >100 to 1000 ppm: Supplied Air, Constant Flow/Pressure Demand, Full Face
Exposure Range >1000 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Note: must change cartridge at beginning of each shift
Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.
Glove Selection Index:

PE/EVAL/PE	A
PVA	A
TEFLON	A
VITON	A
VITON/NEOPRENE	A
NITRILE+PVC	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

BUTYL.....C
NITRILE.....C
NEOPRENE.....C
PVC.....C
NATURAL RUBBER C
BUTYL/NEOPRENE C

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, highly flammable liquid; floats on water. Characteristic aromatic odor. Highly volatile. Mixes with alcohol, chloroform, ether, carbon disulfide, carbon tetrachloride, glacial acetic acid, acetone and oils.

Physical State: Liquid
Vapor Pressure (kPa): 9.95 at 20 °C
Vapor Density (Air=1): 2.77
Formula Weight: 78.12
Specific Gravity (H_2O=1, at 4 °C): 0.879 at 20 °C
Water Solubility: 0.18 g/100 g of water at 25 °C
Evaporation Rate: Fast

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 80.1 °C (176 °F)
Freezing/Melting Point Range: 5.5 °C (41.9 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (man) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 930 mg/kg
Inhalation (rat) LC_{50}: 10000 ppm/7h
Inhalation (human) LC_{Lo}: 2000 ppm/5m
Inhalation (man) TC_{Lo}: 150 ppm/1y - I
Inhalation (human) TC_{Lo}: 100 ppm
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24 hr - mod
Eye (rabbit): 2 mg/24 hr - SEVERE

See NIOSH, *RTECS* CY 1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be subject to rapid volatilization near the surface and that which does not evaporate will be highly to very highly mobile in the soil and may leach to groundwater. It may be subject to biodegradation based on reported biodegradation of 24% and 47% of the initial 20 ppm in a base-rich para-brownish soil in 1 and 10 weeks, respectively. It may be subject to biodegradation in shallow, aerobic groundwaters, but probably not under anaerobic conditions. If released to water, it will be subject to rapid volatilization; the half-life for evaporation in a wind-wave tank with a moderate wind speed of 7.09 m/sec was 5.23 hours; the estimated half-life for volatilization from a model river one meter deep flowing 1 m/sec with a wind velocity of 3 m/sec is estimated to be 2.7 hours at 20 °C. It will not be expected to significantly adsorb to sediment, bioconcentrate in aquatic organisms or hydrolyze. It may be subject to biodegradation based on a reported biodegradation half-life of 16 days in an aerobic river die-away test. In a marine ecosystem biodegradation occurred in 2 days after an acclimation period of 2 days and 2 weeks in the summer and spring, respectively, whereas no degradation occurred in winter. According to one experiment, it has a half-life of 17 days due to photodegradation which could contribute to removal in situations of cold water, poor nutrients, or other conditions less conductive to microbial degradation. If released to the atmosphere, it will exist predominantly in the vapor phase. Gas-phase will not be subject to direct photolysis but it will react with photochemically produced hydroxyl radicals with a half-life of 13.4 days calculated using an experimental rate constant for the reaction. The reaction time in polluted atmospheres which contain nitrogen oxides or sulfur dioxide is accelerated with the half-life being reported as 4-6 hours. Products of photooxidation include phenol, nitrophenols, nitrobenzene, formic acid, and peroxyacetyl nitrate. It is fairly soluble in water and is removed from the atmosphere in rain.

Ecotoxicity: LC_{50} Clawed toad (3-4 wk after hatching) 190 mg/l/48 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (bass) 5.8 to 10.9 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Poecilia reticulata (guppy) 63 ppm/14 days /Conditions of bioassay not specified; LC_{50} Salmo trutta (brown trout yearlings) 12 mg/l/1 hr (static bioassay); LD_{50} Lepomis macrochirus (bluegill sunfish) 20 mg/l/24 to 48 hr /Conditions of bioassay not specified; LC_{100} Tetrahymena pyriformis (ciliate) 12.8 mmole/l/24 hr /Conditions of bioassay not specified; LC_{50} Cancer magister (crab larvae) stage 1, 108 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 20 ppm/96 hr /Conditions of bioassay not specified

Henry's Law Constant: 5.3×10^{-3}

BCF: eels 3.5

Biochemical Oxygen Demand (BOD): 1.2 lb/lb, 10 days

Octanol/Water Partition Coefficient: log $K_{ow} = 2.13$

Soil Sorption Partition Coefficient: K_{oc} = woodburn silt loam 31 to 143

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: BENZENE
Hazard Class: 3.1
ID No.: 1114
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information:

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U019 Toxic Waste; Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per RCRA Section 3001; per CWA Section 307(a); per CAA Section 112 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification 51/57

Material Name: Benzo[*b*]fluoranthene **CAS Number:** 205-99-2
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 205-911-9
Synonyms: B B F; B E F; B (B) F; B(B)F; B(E)F; BBF; BEF; 3,4-BENZ(E)ACEPHENANTHRYLENE; BENZ(E)ACEPHENANTHRYLENE; 2,3-BENZFLUORANTHENE; 3,4-BENZFLUORANTHENE; BENZO(B) FLUORANTHENE; BENZO[*B*]FLUORANTHENE; 2,3-BENZOFLUORANTHENE; 3,4-BENZOFLUORANTHENE; BENZO(B)FLUORANTHENE; BENZO(E)FLUORANTHENE; BENZO[B]FLUORANTHENE; 2,3-BENZOFLUORANTHRENE
Derivation: No manufacturing information available; found in coal tar, coke oven emissions, cigarette smoke and automobile exhaust. There is no commercial production of this compound in the U.S.
General Use: Used as a research chemical.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo[*b*]fluoranthene	205-99-2	ca 100% wt

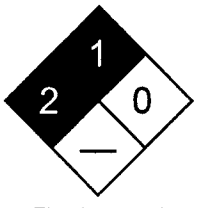
(Note that, except when in the form of a laboratory research chemical, benzo[*b*]fluoranthene is typically found in mixtures with other PAHs (polycyclic aromatic hydrocarbons), such as coal tar pitch).

OSHA PEL
No data found.

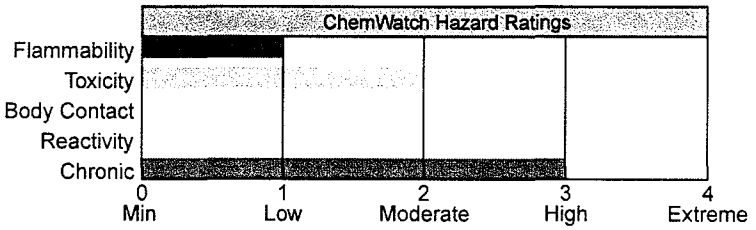
NIOSH REL
No data found.

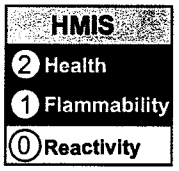
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo[*b*]fluoranthene is a solid in the form of colorless needles. It can be irritating to the respiratory tract, skin and eyes. Like some other PAHs (polycyclic aromatic hydrocarbons), benzo[b]fluoranthene is a possible human carcinogen and mutagen. Handle with care! When heated to decomposition, benzo[*b*]fluoranthene will emit carbon monoxide (CO) and carbon dioxide (CO_2).

Potential Health Effects

Target Organs: Eyes, skin, respiratory system, gastrointestinal (GI) system, blood, liver, kidneys
Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption
Acute Effects
Inhalation: Irritation may result from inhalation of benzo[*b*]fluoranthene dust or fumes.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation.
Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Although there is no direct epidemiological evidence linking benzo[*b*]fluoranthene with cancer, it is frequently a component of mixtures associated with human cancer. Epidemiological studies demonstrate increased incidence of cancer (skin, lung, urinary tract, GI system) with exposure to mixed PAHs and substances that contain them. Coal tar pitch volatiles are reported to cause an excess of bronchitis. In animal studies, benzo[*b*]fluoranthene has been found to be tumorigenic and mutagenic.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develop.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat overexposure symptomatically and supportively. Medical surveillance may be necessary for high exposures (skin, mouth, GI, respiratory system). Animal testing suggests a synergism (combined effect greater than sum of parts) of mutagenicity between benzo[*b*]fluoranthene and other PAHs.

Section 5 - Fire-Fighting Measures

Flash Point: Probable combustible solid

Autoignition Temperature: None reported.

LEL: None reported.

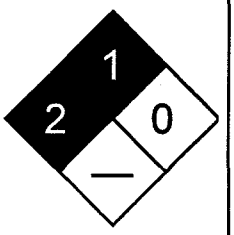
UEL: None reported.

Flammability Classification: Probable combustible solid

Extinguishing Media: Use water spray; carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Heating benzo[*b*]fluoranthene to decomposition can produce carbon monoxide (CO) and carbon dioxide (CO_2).

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.



Fire Diamond

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, isolate area and deny entry. Remove sources of ignition, and provide maximum ventilation.

Small Spills: Vacuum or carefully scoop up material and deposit in sealed containers. Absorb liquid containing benzo[*b*]fluoranthene with vermiculite, earth, sand or similar material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Stay upwind and have cleanup personnel protect against inhalation and contact.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation, and skin and eye contact. Avoid sunlight exposure of contaminated skin. Use only with ventilation sufficient to reduce airborne concentrations as low as possible. Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Work with benzo[*b*]fluoranthene only under an exhaust hood. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Have employees with potential for exposure submit to preplacement and periodic medical examinations with emphasis on oral cavity (including sputum cytology), respiratory tract, skin (chronic disorders, lesions), blood (complete count), bladder and kidneys (urinalysis: specific gravity, albumin, glucose, microscopic examination of sediment; urinary cytology). Repeat medical exam on an annual basis, or on a semi-annual basis for employees 45 years or older or with 10 or more years of exposure to pitch volatiles. Periodically inspect lab atmospheres, and surfaces such as walls, floors, and benches and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading to areas where benzo[*b*]fluoranthene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear splash-proof chemical safety goggles, and face shield (8-inch minimum), per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For any detectable concentration (of coal tar pitch volatiles) use SCBA with full facepiece operated in pressure-demand or other positive pressure mode, or supplied-air respirator with full facepiece operated in pressure-demand or other positive pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive pressure mode; escape, air purifying full face respirator (gas mask) with a chin-style or a front- or back-mounted organic vapor canister and with a full facepiece and a fume or high-efficiency filter, or escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless needles
Physical State: Solid
Vapor Pressure (kPa): 5 x10^{-7} mm Hg at 68 °F (20 °C)
Formula Weight: 252.32
Freezing/Melting Point: 334.4 °F (168 °C)
Water Solubility: 0.0012 mg/L

Other Solubilities: 95% ethanol: <1 mg/mL at 66 °F (19 °C); acetone: 10-50 mg/mL at 66 °F (19 °C); benzene: slightly soluble; DMSO: 10-50 mg/mL at 66 °F (19 °C).

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo[*b*]fluoranthene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Heat, sunlight.

Storage Incompatibilities: Include strong oxidizing agents.

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo[*b*]fluoranthene will produce carbon monoxide (CO) and carbon dioxide (CO_2).

Section 11 - Toxicological Information

Other Effects:

Tumorgenicity, mouse, skin: 88 ng/kg/120 weeks intermittently produced toxic effects: tumorigenic - carcinogenic by RTECS criteria; skin and appendages - tumors; tumorigenic - tumors at site of application.

Hamster, lung cells: 100 µg/L produced morphological transformation.

Mouse, skin: 4037 µg/kg/20 days intermittently produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors.

Rat, intraperitoneal: 100 mg/kg resulted in DNA adducts.

Mouse, skin: 72 mg/kg/60 weeks intermittently produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors; tumorigenic - tumors at site of application.

Rat, intraperitoneal: 100 mg/kg induced sister chromatid exchange.

Rat, implant: 5 mg/kg produced toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; lungs, thorax, or respiration - tumors; tumorigenic - tumors at site of application.

Human, lymphocyte cells: 55 µg/L produced mutation.

See NIOSH, *RTECS* CU1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Benzo[*b*]fluoranthene has a low vapor pressure and Henry's Law Constant, and will not readily evaporate from water or soil. In surface water, it will partition from the water column to suspended sediments. Limited bioconcentration in aquatic organisms may occur (polychaete worms, BCF = 9.1); however, fish have an enzyme (microsomal oxidase) capable of rapidly metabolizing PAHs. Photolysis, photo-oxidation, and volatilization of dissolved benzo[*b*]fluoranthene may occur, but adsorption to suspended sediments is expected to inhibit these processes. Release to the soil may result in some biodegradation. Photolysis is not expected to be significant after release to soil. In the atmosphere it is likely to be adsorbed to particulate matter, and will be subject to wet and dry deposition. In the atmosphere, benzo[*b*]fluoranthene will rapidly degrade by reaction with photochemically produced hydroxyl radicals (half life 1.00 day). A high K_{oc} indicates significant sorption and low mobility in the soil column.
Ecotoxicity: Evidence suggests that PAHs in lake bottom sediments may cause tumors in fish.
Henry's Law Constant: 1.38 x10^{-4} atm-m^3/mole, estimated
Octanol/Water Partition Coefficient: log K_{ow} = 6.124
Soil Sorption Partition Coefficient: K_{oc} = 5.88, estimated

Section 13 - Disposal Considerations

Disposal: Benzo[*b*]fluoranthene is a good candidate for rotary kiln incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9

Additional Shipping Information: *If in a quantity in one package which equals or exceeds the final reportable quantity of 1 lb (0.454 kg).

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed
CERCLA 40 CFR 302.4: Listed per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Not listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification 55/ 57

Material Name: Benz[a]anthracene **CAS Number:** 56-55-3
Chemical Formula: $C_{18}H_{12}$
EINECS Number: 200-280-6
Synonyms: B(A)A; BA; BAA; 1,2-BENZ(A)ANTHRACENE; 1,2-BENZANTHRACENE; BENZ(A)ANTHRACENE; BENZANTHRACENE; BENZ[A]ANTHRACENE; 1,2-BENZANTHRAZEN; 1,2-BENZANTHRENE; BENZANTHRENE; 1,2-BENZOANTHRACENE; BENZO(A)ANTHRACENE; BENZOANTHRACENE; 2,3-BENZOPHENANTHRENE; BENZO(A)PHENANTHRENE; BENZO(B)PHENANTHRENE; 2,3-BENZPHENANTHRENE; NAPHTHANTHRACENE; TETRAPHENE
General Use: research chemistry

Section 2 - Composition / Information on Ingredients

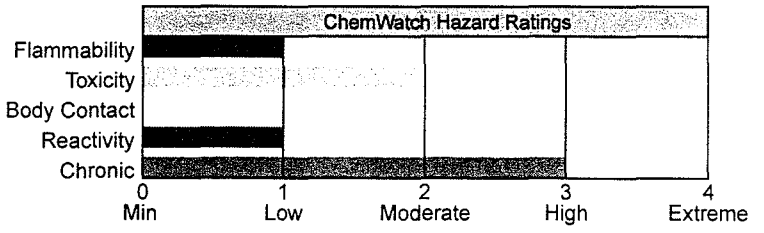
Name	CAS	%
benz[a]anthracene	56-55-3	>98

OSHA PEL
No data found.

NIOSH REL
No data found.

ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



ANSI Signal Word

Danger!


Poison

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless plates. May cause irritation. Poison. Other Acute Effects: may be fatal if inhaled, swallowed, or absorbed through skin. Chronic Effects: may cause heritable genetic damage; may alter genetic material. Carcinogen. Will burn.

Potential Health Effects

Target Organs: No data found.
Primary Entry Routes: accidental skin and eye contact, inhalation of generated dusts
Acute Effects

Inhalation: The dust is harmful and discomforting to the upper respiratory tract. Persons with impaired respiratory function, airway diseases, or conditions such as emphysema or chronic bronchitis may incur further disability if excessive concentrations of particulate are inhaled.

Eye: The dust may be discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/ or other transient eye damage/ ulceration.

Skin: The material may be mildly discomforting to the skin. Open cuts and abraded or irritated skin should not be exposed to this material. Toxic effects may result from skin absorption.

Ingestion: The solid/dust is discomforting to the gastrointestinal tract and harmful if swallowed. Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Chronic Effects: Cited in many publications and by a number of regulatory authorities as a suspected human carcinogen. Subcutaneous injection produces sarcomas (soft tissue growths) in rats and mice. When administered by gavage benz[a]anthracene induced papillomas to the forestomach in mice and hamsters and mammary tumors in female rats.

Section 4 - First Aid Measures

Inhalation: • If dust is inhaled, remove to fresh air.
• Encourage patient to blow nose to ensure clear breathing passages.
• Rinse mouth with water. Consider drinking water to remove dust from throat.
• Seek medical attention if irritation or discomfort persist.
• If fumes or combustion products are inhaled, remove to fresh air.
• Lay patient down. Keep warm and rested.
• Other measures are usually unnecessary.

Eye Contact: • Immediately hold the eyes open and flush with fresh running water.
• 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.
• Seek medical attention if pain persists or recurs.
• Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: • Immediately remove all contaminated clothing, including footwear (after rinsing with water).
• Wash affected areas thoroughly with water (and soap if available).
• Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center. If more than 15 minutes from a hospital:
• INDUCE vomiting with IPECAC SYRUP, or fingers down the back of the throat, ONLY IF CONSCIOUS. Lean patient forward or place on left side (head-down position, if possible) to maintain open airway and prevent aspiration. NOTE: Wear a protective glove when inducing vomiting by mechanical means.
• SEEK MEDICAL ATTENTION WITHOUT DELAY.
• In the meantime, qualified first-aid personnel should treat the patient following observation and employing supportive measures as indicated by the patient's condition.
• If the services of a medical officer or medical doctor are readily available, the patient should be placed in his/her care and a copy of the MSDS should be provided.
• If medical attention is not available on the worksite or surroundings send the patient to a hospital together with a copy of the MSDS.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: Not available; probably combustible

Extinguishing Media: Foam. Dry chemical powder. BCF (where regulations permit). Carbon dioxide. Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: • Solid which exhibits difficult combustion or is difficult to ignite.
• Avoid generating dust, particularly clouds of dust in a confined or unventilated space, as dust may form an explosive mixture with air and any source of ignition, e.g., flame or spark, will cause fire or explosion.
• Dry dust can also be charged electrostatically by turbulence, pneumatic transport, pouring, in exhaust ducts and during transport.
• Build-up of electrostatic charge may be prevented by bonding and grounding.
• Powder handling equipment such as dust collectors, dryers and mills may require additional protection measures such as explosion venting.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e., nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: • Contact fire department and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves for fire only.
• Prevent, by any means available, spillage from entering drains or waterways.
• Use fire fighting procedures suitable for surrounding fire.
• Do not approach containers suspected to be hot.
• Cool fire-exposed containers with water spray from a protected location.
• If safe to do so, remove containers from path of fire.
• Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: • Clean up all spills immediately.
• Avoid contact with skin and eyes.
• Wear protective clothing, gloves, safety glasses and dust respirator.
• Use dry clean up procedures and avoid generating dust.
• Vacuum up or sweep up.
• Place in clean drum then flush area with water.
Large Spills: • Clear area of personnel and move upwind.
• Contact fire department and tell them location and nature of hazard.
• Wear breathing apparatus plus protective gloves.
• Prevent, by any means available, spillage from entering drains or waterways.
• No smoking, bare lights or ignition sources.
• Increase ventilation.
• Stop leak if safe to do so.
• Water spray or fog may be used to disperse/absorb vapor.
• Contain or absorb spill with sand, earth or vermiculite.
• Collect recoverable product into labeled containers for recycling.
• Collect solid residues and seal in labeled drums for disposal.
• Wash area and prevent runoff into drains.
• After clean up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
• If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: • Avoid all personal contact, including inhalation.
• Wear protective clothing when risk of overexposure occurs.
• Use in a well-ventilated area.
• Prevent concentration in hollows and sumps.
• DO NOT enter confined spaces until atmosphere has been checked.
• Do not allow material to contact humans, exposed food or food utensils.
• Avoid smoking, bare lights or ignition sources.
• When handling, DO NOT eat, drink or smoke.
• Avoid contact with incompatible materials.
• Keep containers securely sealed when not in used.
• Avoid physical damage to containers.
• Always wash hands with soap and water after handling.
• Working clothes should be laundered separately. Launder contaminated clothing before reuse.
• Follow good occupational work practices.
• Observe manufacturer's storage/handling recommendations.
• Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Glass container. Plastic container. Metal can. Metal drum. Check that all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Local exhaust ventilation usually required. If risk of overexposure exists, wear NIOSH-approved respirator. Provide adequate ventilation in warehouse or closed storage area.
Personal Protective Clothing/Equipment:
Eyes: Safety glasses with side shields or chemical goggles. Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Wear chemical protective gloves, e.g. PVC. Wear safety footwear.
Other: • Overalls.
• PVC Apron.
• PVC protective suit may be required if exposure severe.
• Eyewash unit.
• Ensure there is ready access to a safety shower.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light yellow to tan crystalline powder.
Physical State: colorless plates **Vapor Pressure (kPa):** 5 x10^{-9} torr at 20 °C

Formula Weight: 228.29
Evaporation Rate: Half life 89 hours
Boiling Point: Sublimes at 435 °C (815 °F)
Freezing/Melting Point: 162 °C (323.6 °F)
Volatile Component (% Vol): Negligible
Water Solubility: 0.014 mg/L in Water at 25 °C

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid reaction with oxidizing agents.

Section 11 - Toxicological Information

Toxicity
Intravenous (rat) LD_{50}: > 200 mg/kg

Irritation
Nil reported

See NIOSH, *RTECS* CV9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: When released into water it will rapidly become adsorbed to sediment or particulate matter in the water column, and bioconcentrate into aquatic organisms. In the unadsorbed state, it will degrade by photolysis in a matter of hours to days. Its slow desorption from sediment and particulate matter will maintain a low concentration in the water. Because it is strongly adsorbed to soil it will remain in the upper few centimeters of soil and not leach into groundwater. It will very slowly biodegrade when colonies of microorganisms are acclimated but this is too slow a process (half-life ca 1 year to be significant). In the atmosphere it will be transported long distances and will probably be subject to photolysis and photooxidation although there is little documentation about the rate of these processes in the literature.
Ecotoxicity: Algae: Anabaena flos-aquae 2w EC_{50} growth +0.014 mg/l NOEC growth +0.003 mg/l
BCF: daphnia 4.0
Octanol/Water Partition Coefficient: log K_{ow} = 5.61
Soil Sorption Partition Coefficient: K_{oc} = sediments 55 to 1.87 x10^6

Section 13 - Disposal Considerations

Disposal: • Recycle wherever possible or consult manufacturer for recycling options.
• Follow applicable local, state, and federal regulations.
• Bury residue in an authorized landfill.
• Recycle containers if possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: TOXIC SOLID, ORGANIC, N.O.S.
Hazard Class: 6.1
ID No.: 2811
Packing Group: III
Label: Harmful[6]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U018 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 10 lb (4.535 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification 43/57

Material Name: Benzo(a)pyrene **CAS Number:** 50-32-8
Chemical Formula: $C_{20}H_{12}$
EINECS Number: 200-028-5
Synonyms: B(A)P; BAP; BENZO(D,E,F)CHRYSENE; 3,4-BENZOPIRENE; 1,2-BENZOPYRENE; 3,4-BENZOPYRENE; 6,7-BENZOPYRENE; BENZO(A)PYRENE; 3,4-BENZPYREN; 3,4-BENZ(A)PYRENE; 3,4-BENZPYRENE; BENZ(A)PYRENE; BENZ[A]PYRENE; 3,4-BENZYLPYRENE; 3,4-BENZYPYRENE; 3,4-BP; BP; COAL TAR PITCH VOLATILES: BENZO(A)PYRENE
Derivation: Synthesized from pyrene and succinic anhydride.
General Use: Benzo(a)pyrene is no longer used or produced commercially in the US. In its pure form, benzo(a)pyrene may be used as a research laboratory reagent. It also occurs in combustion products of coal, oil, petroleum, wood and other biological matter; in motor vehicle and other gasoline and diesel engine exhaust; in charcoal-broiled foods; in cigarette smoke and general soot and smoke of industrial, municipal, and domestic origin. It occurs naturally in crude oils, shale oils, coal tars, gases and fly ash from active volcanoes and forest fires.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Benzo(a)pyrene	50-32-8	ca 100% wt

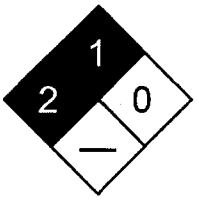
Except in laboratories, benzo(a)pyrene is usually mixed with other coal tar pitch chemicals. Consider exposure limits for coal tar pitch volatiles as a guideline. However, because benzo(a)pyrene is considered a probable carcinogen to humans, it is recommended that exposures to carcinogens be limited to the lowest feasible concentration.

OSHA PEL
TWA: 0.2 mg/m^3.

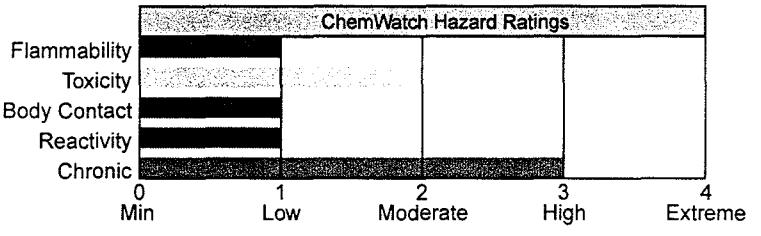
NIOSH REL
No data found.

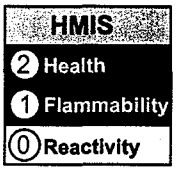
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Benzo(a)pyrene is a pale yellow, crystalline solid or powder that is irritating to the skin, eyes, and respiratory tract. It is a carcinogen and mutagen. Handle with extreme caution!

Potential Health Effects

Target Organs: Respiratory system, bladder, kidneys, skin.
Primary Entry Routes: Inhalation, ingestion.
Acute Effects
Inhalation: Respiratory tract irritation. Pregnant women may be especially susceptible to exposure effects of benzo(a)pyrene; exposure may damage the fetus. In general, polyaromatic hydrocarbons such as benzo(a)pyrene tend to localize primarily in body fat and fatty tissues (for ex. breasts) and are excreted in breast milk. Benzo(a)pyrene may also affect the male reproductive system (testes and sperm).
Eye: Irritation and/or burns on contact.

Skin: Irritation with burning sensation, rash, and redness; dermatitis on prolonged exposure. Sunlight enhances effects (photosensitization).

Ingestion: None reported.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2A, Probably carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A2, Suspected human carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: Respiratory system, bladder, kidney, and skin disorders.

Chronic Effects: Inhalation: Cough and bronchitis. Eye: Photosensitivity and irritation. Skin: Skin changes such as thickening, darkening, pimples, loss of color, reddish areas, thinning of the skin, and warts. Sunlight enhances effects (photosensitization). Other: Gastrointestinal (GI) effects include leukoplakia (a pre-cancerous condition characterized by thickened white patches of epithelium on mucous membranes, especially of the mouth). Cancer of the lung, skin, kidneys, bladder, or GI tract is also possible. Smoking in combination with exposure to benzo(a)pyrene increases the chances of developing lung cancer. Persons with a high degree of inducibility of the enzyme aryl hydrocarbon hydroxylase may be a high risk population.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of tepid water for at least 15 min. Consult an ophthalmologist if irritation or pain persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water (less than 15 min). Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water to dilute. Inducing vomiting is not necessary since benzo(a)pyrene has a low acute toxicity and therefore, is generally an unnecessary procedure. Consider activated charcoal/cathartic.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Monitor CBC and arterial blood gases, conduct liver, renal, and pulmonary function tests (if respiratory tract irritation is present), and urinalysis. Biological monitoring techniques testing for metabolites in blood or urine, or DNA adducts in blood or tissues are useful for epidemiological studies that determine if exposure has occurred. Because neither normal nor toxic levels have been established, those techniques may not be useful for evaluating individual patients.

Special Precautions/Procedures: Emergency personnel should protect against exposure.

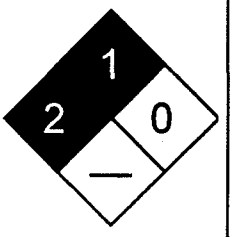
Section 5 - Fire-Fighting Measures

Flash Point: None reported. Benzo(a)pyrene may burn, but does *not* readily ignite.

Autoignition Temperature: None reported.

LEL: None reported.

UEL: None reported.



Fire Diamond

Extinguishing Media: For small fires, use dry chemical, sand, water spray, or foam. For large fires, use water spray, fog, or foam.

General Fire Hazards/Hazardous Combustion Products: Carbon monoxide and carbon dioxide.

Fire-Fighting Instructions: Isolate hazard and deny entry. If feasible and without undue risk, move containers from fire hazard area. Otherwise, cool fire-exposed containers with water spray until well after fire is extinguished. Do not release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode and full protective clothing.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel of large spills, remove heat and ignition sources, and provide adequate ventilation. Cleanup personnel should protect against dust inhalation and skin or eye contact. Clean up spills promptly.

Small Spills: Carefully scoop up spilled material and place into appropriate containers for disposal. For liquid spills, take up with a noncombustible, inert absorbent and place into appropriate containers for disposal.

Large Spills: For large spills, dike far ahead of liquid spill or contain dry spill for later disposal. Do not release into sewers or waterways. *Do not* dry sweep! Use a vacuum with a HEPA filter or a wet method to reduce dust. After cleanup is complete, thoroughly decontaminate all surfaces. *Do not* reuse contaminated cleaning materials.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Handle with extreme caution and take all necessary measures to avoid exposure to benzo(a)pyrene because it is a carcinogen and mutagen. Follow good personal hygiene procedures and thoroughly wash hands with soap and water after handling. Use safety pipettes for all pipetting.
Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed and properly labeled containers in a cool, well-ventilated area.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use a Class I, Type B, biological safety hood when working with benzo(a)pyrene in a laboratory. Decrease the rate of air extraction, so that benzo(a)pyrene can be handled without powder being blown around the hood. Keep glove boxes under negative pressure. Use vertical laminar-flow, 100% exhaust, biological safety cabinets for containment of in vitro procedures. The exhaust air flow should be sufficient to provide an inward air flow at the face opening of the cabinet. Ensure contaminated air sheaths that are under positive pressure are leak-tight. Never use horizontal laminar-flow hoods or safety cabinets where filtered air is blown across the working area towards the operator. Test cabinets before work begins to ensure they are functioning properly. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Consider preplacement and periodic medical examinations with emphasis on the oral cavity, bladder, kidneys, skin, and respiratory tract. Conduct urinalysis including specific gravity, albumin, glucose, and microscopic examination of centrifuged sediment for red blood cells. Also, include 14" x 17" chest roentgenogram, FVC + FEV1, and CBC to detect any leukemia or aplastic anemia. It is recommended that this exam be repeated on an annual basis and semiannual basis for employees 45 yr of age or older or with 10 or more years of exposure to coal tar pitch volatiles. Train workers about the hazards of benzo(a)pyrene and the necessary protective measures to prevent exposure. Periodically inspect lab atmospheres, surfaces such as walls, floors, and benches, and interior of fume hoods and air ducts for contamination. Post appropriate signs and labels on doors leading into areas where benzo(a)pyrene is used.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent prolonged or repeated skin contact. In animal laboratories, wear protective suits (disposable, one-piece and close-fitting at ankles and wrists), gloves, hair covering, and overshoes. In chemical laboratories, wear gloves and gowns. Wear protective eyeglasses or chemical safety, gas-proof goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Because contact lens use in industry is controversial, establish your own policy.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. The following respirator recommendations are for coal tar pitch volatiles. For any unknown concentration, wear any SCBA with a full facepiece and operated in a pressure- demand or other positive pressure mode, or any supplied-air respirator with a full facepiece and operated in a pressure-demand or other positive pressure mode in combination with an auxiliary SCBA operated in pressure-demand or other positive pressure mode. For escape, wear any air-purifying full facepiece respirator (gas mask) with a chin-style or front- or back-mounted organic vapor canister having a high-efficiency particulate filter, or any appropriate escape-type SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Shower and change clothes after exposure or at the end of the workshift. Separate contaminated work clothes from street clothes. Launder before reuse. Remove benzo(a)pyrene from your shoes and clean personal protective equipment. Use procedures to ensure laundry personnel are not exposed. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Pale yellow monoclinic needles with a faint, aromatic odor.

Physical State: Solid

Vapor Pressure (kPa): >1 mm Hg at 68 °F (20 °C)

Formula Weight: 252.30

Specific Gravity (H_2O=1, at 4 °C): 1.351

Boiling Point: >680 °F (>360 °C); 540 °F (310 °C) at 10 mm Hg

Freezing/Melting Point: 354 °F (179 °C)

Water Solubility: Insoluble; 0.0038 mg (+/- 0.00031 mg) in 1 L at 77 °F (25 °C)

Other Solubilities: Ether, benzene, toluene, xylene, concentrated hydrosulfuric acid; sparingly soluble in alcohol, methanol.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Benzo(a)pyrene is stable at room temperature in closed containers under normal storage and handling conditions. It undergoes photo-oxidation when exposed to sunlight or light in organic solvents and is also oxidized by chromic acid and ozone. Hazardous polymerization cannot occur. Avoid heat and ignition sources and incompatibles.

Storage Incompatibilities: Strong oxidizers (chlorine, bromine, fluorine) and oxidizing chemicals (chlorates, perchlorates, permanganates, and nitrates).

Hazardous Decomposition Products: Thermal oxidative decomposition of benzo(a)pyrene can produce carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral: 15 mg/kg produced gastrointestinal and musculoskeletal tumors.

Irritation Effects:

Mouse: 14 µg caused mild irritation.

Other Effects:

Rat, oral: 40 mg/kg on the 14th day of pregnancy caused changes in the extra embryonic structures.

Rat, oral: 2 g/kg administered 28 days prior to mating and 1-22 days of pregnancy produced a stillbirth.

Tumorgenicity, mouse, oral: 75 mg/kg administered to the female during the 12- 14 day of pregnancy produced biochemical and metabolic effects on the newborn.

Mouse, inhalation: 200 ng/m^3/6 hr administered intermittently over 13 weeks produced tumors of the lungs.

Human, HeLa cell: 1500 nmol/L caused DNA inhibition.

Human, lung cell: 1 µmol/L caused DNA damage.

Human, liver cell: 100 nmol/L caused DNA damage.

Rabbit, skin: 17 mg/kg administered intermittently over 57 weeks produced tumors of the skin and appendages.

See NIOSH, *RTECS* DJ3675000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, benzo(a)pyrene adsorbs very strongly to particulate matter and sediments, bioconcentrates in aquatic organisms which cannot metabolize it, but does not hydrolyze. Direct photolysis at the water surface, evaporation, or biodegradation may be important, but adsorption may significantly retard these processes. Adsorption to particulates may also retard direct photolysis when benzo(a)pyrene is released to air. Benzo(a)pyrene may be removed from air by reaction with nitrogen dioxide (half-life, 7 days) or ozone (half-life, 37 min), or photochemically produced hydroxyl radicals (estimated half-life, 21.49 hr). It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils. It will adsorb very strongly to the soil. Although it is not expected to appreciably leach to the groundwater, groundwater samples indicate that it can be transported there. It is not expected to significantly evaporate or hydrolyze from soils and surfaces. However, it may be subject to appreciable biodegradation in soils.

Ecotoxicity: Oysters, BCF (bioconcentration factor): 3000; rainbow trout, BCF: 920; *Daphnia pulex*, BCF: 13,000.

BCF: Some marine organisms such as phytoplankton, certain zooplankton, scallops (*Placopecten sp*), snails (*Litternia littorea*), and mussels (*Mytilus edulis*) lack a metabolic detoxification enzyme system to metabolize benzo(a)pyrene and therefore, tend to accumulate benzo(a)pyrene. Humic acid in solution may decrease bioconcentration.

Octanol/Water Partition Coefficient: log K_{ow} = 6.04

Section 13 - Disposal Considerations

Disposal: Small quantities: 10 mL of a solution containing 0.3 mol/L of potassium permanganate and 3 mol/L of sulfuric acid will degrade 5 mg of benzo(a)pyrene. Also, can treat with sodium dichromate in strong sulfuric acid (1-2 days). Benzo(a)pyrene is also a good candidate for fluidized bed incineration at a temperature range of 842 to 1796 °F (450 to 980 °C) or rotary kiln incineration at 820 to 1600°C. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: Class 9

Additional Shipping Information: * If it is in a quantity, in one package, which equals or exceeds the reportable quantity (RQ) of 1 lb (0.454 kg).

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U022 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 1 lb (0.454 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

Section 1 - Chemical Product and Company Identification 54

Material Name: di-sec-Octyl Phthalate **CAS Number:** 117-81-7
Chemical Formula: $C_{24}H_{38}O_4$
Structural Chemical Formula: $C_6H_4[COOCH_2CH(C_2H_5)(CH_2)_3]_2$
Synonyms: BEHP; 1,2-BENZENEDICARBOXYLIC ACID,BIS(2-ETHYLHEXYL) ESTER; 1,2-BENZENEDICARBOXYLIC ACID,BIS(ETHYLHEXYL) ESTER; BIS(2-ETHYLHEXYL) 1,2-BENZENEDICARBOXYLATE; BIS(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)-1,2-BENZENEDICARBOXYLATE; BIS-(2-ETHYLHEXYL)ESTER KYSELINY FTALOVE; BIS(2-ETHYLHEXYL)ESTER PHTHALIC ACID; BIS(2-ETHYLHEXYL)PHTHALATE; BIS-(2-ETHYLHEXYL)PHTHALATE; BISOFLEX 81; BISOFLEX DOP; COMPOUND 889; DAF 68; DEHP; DI(2-ETHYLHEXYL) PHTHALATE; DI(ETHYLHEXYL) PHTHALATE; DIETHYLHEXYL PHTHALATE; DI(2-ETHYLHEXYL)ORTHOPHTHALATE; DI(2-ETHYLHEXYL)PHTHALATE; DI-2-ETHYLHEXYLPHTHALATE; DI-SEC-OCTYL PHTHALATE; DIOCTYL PHTHALATE; DOF; DOP; ERGOPLAST FDO; ERGOPLAST FDO-S; 2-ETHYLHEXYL PHTHALATE; ETHYLHEXYL PHTHALATE; EVIPLAST 80; EVIPLAST 81; FLEXIMEL; FLEXOL DOP; FLEXOL PLASTICIZER DOP; GOOD-RITE GP 264; HATCOL DOP; HERCOFLEX 260; JAYFLEX DOP; KODAFLEX DOP; MOLLAN O; NUOPLAZ DOP; OCTOIL; OCTYL PHTHALATE; PALATINOL AH; PHTHALIC ACID DIOCTYL ESTER; PHTHALIC ACID,BIS(2-ETHYLHEXYL) ESTER; PITTSBURGH PX-138; PLATINOL AH; PLATINOL DOP; RC PLASTICIZER DOP; REOMOL D 79P; REOMOL DOP; SICOL 150; STAFLEX DOP; TRUFLEX DOP; VESTINOL AH; VINICIZER 80; WITCIZER 312
General Use: Used as a plasticizer for resins, elastomers, vinyl products, films for packaging, containers and electrical cables.
High purity grades used as electrical insulating (dielectric) fluid.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
di-sec-octyl phthalate	117-81-7	>99

OSHA PEL
TWA: 5 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 5 mg/m^3; STEL: 10 mg/m^3.

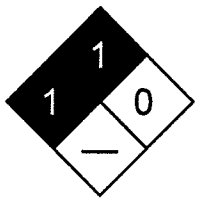
ACGIH TLV
TWA: 5 mg/m^3.

NIOSH REL
TWA: 5 mg/m^3; STEL: 10 mg/m^3.

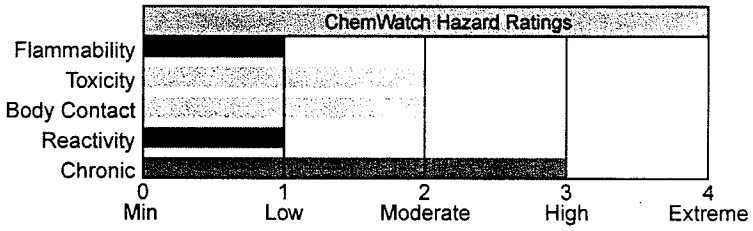
IDLH Level
5000 mg/m^3.

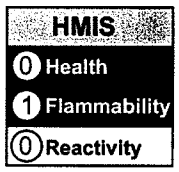
DFG (Germany) MAK
TWA: 10 mg/m^3; ceiling, substances with systemic effects, onset of effect greater than 2 hours, half-life greater than shift length, strongly cumulative.

Section 3 - Hazards Identification



Fire Diamond





☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Light colored liquid; slight odor. Mildly irritating to eyes/skin/respiratory tract. Also causes: conjunctivitis, keratitis, bronchial irritation, eczema, staggering, abdominal cramps, nausea, diarrhea, CNS depression. Possible cancer hazard.

Potential Health Effects

Target Organs: eyes, upper respiratory system, skin, central nervous system (CNS)
Primary Entry Routes: inhalation, ingestion

Acute Effects

Inhalation: Not normally a hazard due to nonvolatile nature of product. Inhalation hazard is increased at higher temperatures.

The mist is discomforting to the upper respiratory tract.

Inhalation of concentrated mists can cause coughing, sneezing, severe irritation, dizziness, headache and nausea.

Eye: The liquid may produce eye discomfort and is capable of causing temporary impairment of vision and/or transient eye inflammation, ulceration. The mist is moderately discomforting to the eyes.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is mildly discomforting to the skin if exposure is prolonged and may cause drying of the skin, which may lead to dermatitis.

Irritation and skin reactions are possible with sensitive skin.

The material may accentuate any pre-existing dermatitis condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid is discomforting and is regarded as harmful if swallowed.

Ingestion may result in nausea, abdominal irritation, pain and vomiting.

Phthalates (aromatic dicarboxylic acid esters), in general, exhibit low toxicity, partly because of poor absorption but mainly as a result of rapid metabolism in which the esters are saponified to phthalic acid (which is rapidly excreted) and the parent alcohol (which is subsequently metabolized). The pathology of these compounds seems to be related to the released alcohol and its biological effects. Testicular atrophy produced in rats during feeding studies depends on the length and structure of the alcohol; in general the lower molecular weight esters produce the more severe effects.

The toxicity of phthalic acid isomers decreases in the order o-phthalic acid, isophthalic acid and terephthalic acid.

Phthalic acid is not metabolized but is excreted, unchanged, in the urine and feces.

Terephthalic acid appears to potentiate the biological effects of substances such as antibiotics, thiamine and sulfonamides.

Carcinogenicity: NTP - Class 2B, Reasonably anticipated to be a carcinogen, sufficient evidence of carcinogenicity from studies in experimental animals; IARC - Group 2B, Possibly carcinogenic to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Not listed.

Chronic Effects: Oral studies of 90-days to 2-years in rat, 1-year in guinea pig and up to 1-year in dog have shown a no-effect level of about 60 mg/kg/day. Higher doses produced growth retardation and increased weights of livers and kidneys.

Rats and mice fed on diets containing 6000-12000 (rats) and 3000-6000 (mice) mg/kg body weight for 103 weeks showed an increased incidence of hepatocellular carcinomas in female rats and male and female mice, and an increased incidence of either hepatocellular carcinomas or neoplastic nodules in male rats. About 35% of the hepatocellular carcinomas in mice had metastasised to the lungs.

The substance can cause testicular damage in rats (dietary and gavage studies) with a no-effect level in 0.3% to 0.5% in the diet. Inhalation or dermal exposures did not produce testicular effects. When the substance was fed to pregnant rats (5 mL/kg) it produced slight effects on embryonic and fetal development with skeletal abnormalities more common.

A Russian study describes exposure by workers to mixed phthalates (and other plasticizers) - pain, numbness and spasms in the upper and lower extremities were related to duration of exposures. Symptoms usually developed after the sixth or seventh year of work. Neurological studies revealed the development of polyneuritis in about 30% of the workers involved in this study. About 30% of the workforce showed depression of the vestibular receptors. Because the study described mixed exposures it is difficult to determine what, if any, unique role was played by the phthalates.

Increased incidences of anovulatory reproductive cycles and low estrogen concentrations were reported among Russian women working with phthalate plasticizers; the abnormal cycles were associated with spontaneous abortion. The specific phthalates implicated, dose levels and other data were not reported.

It has been alleged that the phthalates mimic or interfere with sex hormones. Phthalates are added as plasticizers in plastics (including food packaging) and are used as ingredients in paints, inks and adhesives. Their potential for entering the human body is marked. They have been added to a list of chemicals (including alkyl phenolics, polycyclic aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs) and dioxins) which are implicated in reducing sperm counts and fertility in males a phenomenon which has apparently arisen since the mid 1960s.

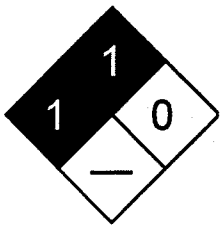
Although the human fetus is "bathed" in naturally occurring estrogens during pregnancy it is suggested that it has developed a protective mechanism against natural estrogens but is not safe from synthetic variants. These tend to accumulate in body fats which sets them apart from the natural product. During early pregnancy, fats are broken down and may flood the body with concentrated pollutants.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.
Eye Contact: Immediately hold eyes open and flush continuously with running water for at least 15 minutes. Ensure irrigation under eyelids.
Seek medical attention without delay.
Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.
Ingestion: Contact a Poison Control Center.
If more than 15 minutes from a hospital, induce vomiting, preferably using Ipecac Syrup APF.
Note: DO NOT INDUCE VOMITING in an unconscious person.
After first aid, get appropriate in-plant, paramedic, or community medical support.
Note to Physicians: Treat symptomatically.

Section 5 - Fire-Fighting Measures

Flash Point: 215 °C Open Cup
Autoignition Temperature: 391 °C
LEL: 0.3% v/v
Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Combustible. Slight fire hazard when exposed to heat or flame.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit acrid smoke.
Mists containing combustible materials may be explosive.
Hot organic vapors or mist are capable of sudden spontaneous combustion when mixed with air even at temperatures below their published autoignition temperatures. The temperature of ignition decreases with increasing vapor volume and vapor/air contact times and is influenced by pressure change.
Ignition may occur under elevated-temperature process conditions especially in processes performed under vacuum subjected to sudden ingress of air or in processes performed at elevated pressure, where sudden escape of vapors or mists to the atmosphere occurs.



Fire Diamond

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with sand, earth, inert material or vermiculite.
Wipe up. Place in a suitable labeled container for waste disposal.
Large Spills: Contact fire department and tell them location and nature of hazard.
Clear area of personnel and move upwind.
Shut off all possible sources of ignition and increase ventilation.
Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
Stop leak if safe to do so.
Absorb or cover spill with sand, earth, inert material or vermiculite.
Recover liquid and place in labeled, sealable container for recycling.

Collect residues and seal in labeled drums for disposal.
Wash spill area with detergent and water.
If contamination of drains or waterways occurs, advise emergency services.
After clean-up operations, decontaminate and launder all protective clothing and equipment before storing and reusing.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Use good occupational work practices.
Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Use in a well-ventilated area.
Avoid generating and breathing mist and vapor.
Avoid contact with incompatible materials.
Avoid prolonged and repeated skin contact.
Avoid smoking, bare lights or ignition sources.
Avoid physical damage to containers.
Keep containers securely sealed when not in use.
Wear personal protective equipment when handling.
When handling, DO NOT eat, drink or smoke.
Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: None under normal operating conditions. OTHERWISE: General exhaust is adequate under normal operating conditions.
If inhalation risk of overexposure exists, wear NIOSH-approved organic-vapor respirator.
If mist is present, use air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream and Nitrile rubber gloves or Neoprene rubber gloves.
Safety footwear.
Respiratory Protection:
Exposure Range >5 to 50 mg/m^3: Air Purifying, Negative Pressure, Half Mask
Exposure Range >50 to 500 mg/m^3: Air Purifying, Negative Pressure, Full Face
Exposure Range >500 to <5000 mg/m^3: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 5000 to unlimited mg/m^3: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: dust/mist filter (use P100 or consult supervisor for appropriate dust/mist filter)
Other: Overalls. Eyewash unit.
Glove Selection Index:
BUTYL.....Best selection
VITON.....Best selection
NITRILE.....Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Light-colored, odorless and oily liquid. Mixes with mineral oil and most organic solvents.
Physical State: Liquid
Vapor Pressure (kPa): 0.17 at 200 °C
Vapor Density (Air=1): 13.45
Formula Weight: 390.54
Specific Gravity (H_2O=1, at 4 °C): 0.99 at 20 °C
Water Solubility: < 0.01% at 25 °C
Evaporation Rate: Very Slow
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 230 °C (446 °F) at 5 mm Hg
Freezing/Melting Point Range: -50 °C (-58 °F)

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Hazardous polymerization will not occur. Stable under normal storage conditions.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD_{50}: 30000 mg/kg
Oral (human) TD_{Lo}: 143 mg/kg
Oral (mouse) LD_{50}: 1500 mg/kg
Oral (rabbit) LD_{50}: 34000 mg/kg
Dermal (rabbit) LD_{50}: 25000 mg/kg
Intraperitoneal (rabbit) LD_{50}: >31 mL/kg
Oral (guinea pig) LD_{50}: 26000 mg/kg
Dermal (g.pig) LD_{50}: 10000 mg/kg

IRRITATION
Skin (rabbit): 500 mg/24 hr mild
Eye (rabbit): 500 mg/24 hr mild

Gastrointestinal changes, respiratory system changes, somnolence, hemorrhage, necrotic changes in GI tract, lowered blood pressure, liver, endocrine tumors, feto toxicity, paternal effects, maternal effects, specific developmental abnormalities (hepatobiliary system, musculoskeletal system, cardiovascular system, urogenital system, central nervous system, eye/ear), fetolethality recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

See NIOSH, *RTECS* TI 0350000, for additional data.

Section 12 - Ecological Information

Environmental Fate: In water it will biodegrade (half-life 2-3 wk), adsorb to sediments and bioconcentrate in aquatic organisms. Atmospheric material will be carried long distances and be removed by rain.
Ecotoxicity: LC_{50} Gammarus pseudolimnaeus more than 32 mg/l/96 hr at 21 °C; juvenile /static bioassay; LC_{50} Ictalurus punctatus (channel catfish) more than 100 mg/l/96 hr at 20 °C; wt 1.5 g /static bioassay; EC_{50} Gymnodinium breve growth rate 3.1% vol/vol/96 hr /Conditions of bioassay not specified; LC_{50} Oncorhynchus kisutch (coho salmon) more than 100 mg/l/96 hr at 16 °C; wt 1.5 g /static bioassay; LC_{50} Daphnia magna: 1,000-5,000 ug/l/48 hr /Conditions of bioassay not specified; LC_{50} Chironomus plumosus (Midge): > 18,000 ug/l/48 hr /Conditions of bioassay not specified
Henry's Law Constant: 1×10^{-4}
BCF: fish 2
Biochemical Oxygen Demand (BOD): acclimated < 1 lb/lb, 5 days
Octanol/Water Partition Coefficient: $\log K_{ow} = 4.89$
Soil Sorption Partition Coefficient: $K_{oc} = 4$ to 5

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NONE
Hazard Class: None
ID No.: None
Packing Group: None
Label: No class label assigned

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U028 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification 51/57

Material Name: Chrysene **CAS Number:** 218-01-9
Chemical Formula: $C_{18}H_{12}$
EINECS Number: 205-923-4
Synonyms: BENZO (A) PHENANTHRENE; BENZO[A]PHENANTHRENE; 1,2-BENZOPHENANTHRENE; BENZO(A)PHENANTHRENE; 1,2-BENZPHENANTHRENE; BENZ(A)PHENANTHRENE; CHRYSENE; COAL TAR PITCH VOLATILES: CHRYSENE; 1,2,5,6-DIBENZONAPHTHALENE
Derivation: Distilled from coal tar, coal tar pitch. A small amount is produced from the distillation or pyrolysis of many fats and oils. By heating hydrogen and acetylene. Chrysene is not produced commercially in the U.S. (except as a laboratory research chemical).
General Use: Used in organic synthesis; as a research chemical. Occurs in cigarette smoke.

Section 2 - Composition / Information on Ingredients

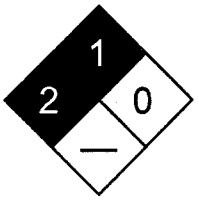
Name	CAS	%
No data found.		

OSHA PEL
TWA: 0.2 mg/m^3.

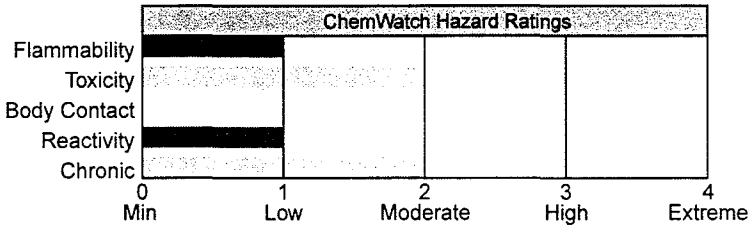
NIOSH REL
No data found.

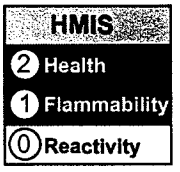
ACGIH TLV
Exposure by all routes should be carefully controlled to levels as low as possible.

Section 3 - Hazards Identification



Fire Diamond





ANSI Signal Word

Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Chrysene exists as colorless to white crystals with reddish-blue fluorescence. This poycyclic aromatic hydrocarbon (PAH) is often present in mixtures of PAHs. May be irritating to skin, eyes, and respiratory system. It may be absorbed through the skin. Animal data indicate that chrysene may be cancer-causing in humans. Handle with care. Chrysene is combustible.

Potential Health Effects

Target Organs: Eyes, skin, respiratory system
Primary Entry Routes: Skin absorption
Acute Effects *There is no human evidence available for the acute health effects of chrysene alone. There is, however, considerable data indicating that it is carcinogenic in humans. Based on the chemical properties of chrysene, as a polynuclear aromatic hydrocarbon, the following acute effects may occur.*
Inhalation: May cause irritation.
Eye: . May cause irritation.
Skin: May cause irritation or be absorbed.
Ingestion: None reported.
Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Listed as carcinogen; ACGIH - Class A3, Animal carcinogen; EPA - Class B2, Probable human carcinogen based on animal studies; MAK - Class A2, Unmistakably carcinogenic in animal experimentation only.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Animal data indicate that chronic exposure to chrysene and other coal tar pitch volatiles probably causes cancer. May also cause respiratory, skin, or eye irritation; cough, bronchitis, photosensitivity, "coal tar warts" (precancerous lesions enhanced by UV light exposure), erythema (skin inflammation), dermal burns, acneiform lesions, hematuria (blood in urine). May alter genetic material. Exposure to PAH's is believed to cause leukoplakia (precancerous patches on the tongue), lip and oral cavity cancers, and bladder cancer.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For high exposures, medical surveillance (skin, mouth, GI tract, respiratory system) may be necessary.

Section 5 - Fire-Fighting Measures

Flash Point: Combustible solid

Autoignition Temperature: None reported.

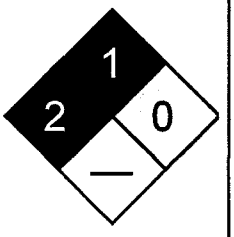
LEL: None reported.

UEL: None reported.

Flammability Classification: Combustible solid

Extinguishing Media: Use water spray, carbon dioxide, dry chemical powder or appropriate foam.

General Fire Hazards/Hazardous Combustion Products: Acrid smoke and fumes, including carbon monoxide and carbon dioxide.



Fire Diamond

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Tag container as defective and return to supplier. Use spark-proof tools and explosion-proof equipment.

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: Large spills of chrysene are unlikely. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid dust inhalation and skin and eye contact. Use only with adequate ventilation to maintain concentrations at nonhazardous levels (see Sec. 2). Wear personal protective clothing and equipment to prevent contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid dust dispersion into the work area. Ventilate at the site of chemical release. To prevent static sparks, electrically ground and bond all containers and equipment. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PEL (see Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with this material. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the skin and lungs.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Wear protective eyeglasses or chemical safety goggles, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Air purifying respirators may be adequate for handling small amounts of chrysene in a laboratory setting. For unlimited exposure ranges, wear a pressure-demand, full-face SCBA. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder clothing separately before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless to white rhombic plates with reddish-blue fluorescence.

Physical State: Solid

Vapor Pressure (kPa): 6.3 x10^{-7} mm Hg; 6.3 x10^{-9} mm Hg at 68 °F (20 °C)

Formula Weight: 228.28

Specific Gravity (H_2O=1, at 4 °C): 1.274 at 20 °C/4 °C

Refractive Index: 2610

Boiling Point: 838 °F (448 °C); sublimes easily in a vacuum

Freezing/Melting Point: 489 °F (254 °C) to 496 °F (258 °C)

Ionization Potential (eV): 7.59 +/- 0.2 eV

Water Solubility: Insoluble (0.0018 mg/kg)

Other Solubilities: Slightly soluble in 95% ethanol, acetone, carbon disulfide, ether, glacial acetic acid. Soluble in hot benzene, toluene.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Chrysene is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Avoid contact with chemical incompatibles, heat and ignition sources.

Storage Incompatibilities: Include strong oxidizers.

Hazardous Decomposition Products: Thermal oxidative decomposition of chrysene can produce acrid smoke and fumes, including carbon monoxide and carbon dioxide.

Section 11 - Toxicological Information

Acute Skin Effects:\
Mouse, skin: 192 µmol/kg produced DNA adducts.\
Mouse, skin, TD_{Lo}: 3600 µg/kg.\

Other Effects:\
Tumorgenicity, mouse, skin: 23 mg/kg; toxic effects: tumorigenic - neoplastic by RTECS criteria; skin and appendages - tumors.\
Human, lymphocyte: 6 µmol/L produced mutation.\
Mouse, intraperitoneal, LD_{50}: >320 mg/kg.\
Tumorigenic Effects: Mouse, skin, 3600 mg/kg for 30 weeks, intermittent; toxic effects: tumorigenic - equivocal tumorigenic agent by RTECS criteria; skin and appendages - tumors.\
Hamster, intraperitoneal: 900 mg/24 hr induced sister chromatid exchange.\
Bacteria, *S typhimurium*: 5 mg/plate (-S9) produced mutation.

See NIOSH, *RTECS* GC0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to water, it will adsorb very strongly to sediments and particulate matter, but will not hydrolyze or appreciably evaporate. It will bioconcentrate in species which lack microsomal oxidase. Calculated BCF: 4,230. K_{ow} indicates bioaccumulation, which could cause food-chain contamination. It will not hydrolyze or appreciably evaporate from soils or surfaces. The estimated biodegradation half-life in soil is 7 years. The estimated half-life of any gas phase in the atmosphere is 1.25 hours as a result of reaction with photochemically produced hydroxyl radicals. It will be subject to near-surface, direct photolysis with a half-life of 4.4 hours computed for exposure to sunlight at mid-day in midsummer at latitude 40°N. If released to air, it will be subject to direct photolysis, although adsorption to particulates may affect the rate of this process. If released to soil it will be expected to adsorb very strongly to the soil and will not be expected to leach appreciably to groundwater.

Ecotoxicity: *Anabaena flos-aquae* (algae), 2 weeks, EC_{35} growth: +/- 0.002 mg/L. *Daphnia magna* (crustaceans), 2 hr, LC_{50}: 1.9 mg/L. *Rana pipiens* (amphibians), 24 hr, LC_{50}: >6.7 mg/L. *Neanthes arenaceodentata* (fishes), 96 hr, LC_{50}: >1 mg/L.

Henry's Law Constant: 9.4×10^{-8}

Octanol/Water Partition Coefficient: log K_{ow} = 5.61 to 5.91

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. One method is to dissolve or mix the material with a combustible solvent and burn in an incinerator equipped with an afterburner and scrubber. Handle empty containers carefully as hazardous residues may still remain. Triple rinse containers and dispose of wash wastewater appropriately.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Environmentally hazardous substances, solid, n.o.s.*
Hazard Class: 9
ID No.: UN3077
Packing Group: III
Label: CLASS 9

Additional Shipping Information: *If in a quantity in one package which equals or exceeds the final reportable quantity (RQ) of 100 lb (45.4 kg)

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U050 Toxic Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Ethylbenzene
MSDS 385
ETH3050

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Ethylbenzene **CAS Number:** 100-41-4
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_5 \cdot C_2H_5$
Synonyms: AETHYLBENZOL; BENZENE,ETHYL-; EB; ETHYL BENZENE; ETHYLBENZEEN; ETHYLBENZENE; ETHYLBENZOL; ETILBENZENE; ETYLOBENZEN; PHENYLETHANE
General Use: Used in the manufacture of cellulose acetate, styrene and synthetic rubber; solvent or diluent; component of automotive and aviation gasoline.
Component of many petroleum hydrocarbon solvents, thinners.
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.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
ethylbenzene	100-41-4	>95

OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 435 mg/m^3;
STEL: 125 ppm; 545 mg/m^3.

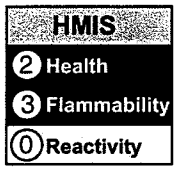
ACGIH TLV
TWA: 100 ppm; 434 mg/m^3;
STEL: 125 ppm; 543 mg/m^3.

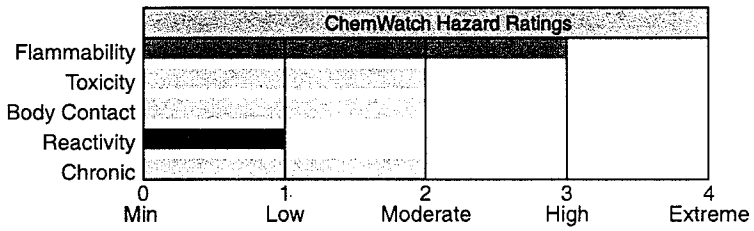
NIOSH REL
TWA: 100 ppm; 435 mg/m^3.
STEL: 125 ppm; 545 mg/m^3.

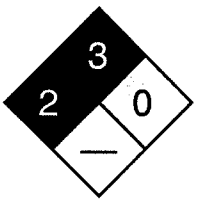
IDLH Level
800 ppm; LEL.

DFG (Germany) MAK
TWA: 100 ppm; 440 mg/m^3.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; pungent odor. Irritating to eyes/skin/respiratory tract. Also causes: chest constriction, vertigo, narcosis, cramps, respiratory paralysis. Chronic: fatigue, sleepiness, headache, blood disorders, lymphocytosis. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin contact, eye contact
Target Organs: eyes, respiratory system, skin, central nervous system (CNS), blood
Acute Effects
Inhalation: The vapor is discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Inhalation of vapor may aggravate a pre-existing respiratory condition such as asthma, bronchitis, emphysema.

When humans were exposed to the 100 and 200 ppm for 8 hours about 45-65% is retained in the body. Only traces of unchanged ethyl benzene are excreted in expired air following termination of inhalation exposure.

Humans exposed to concentrations of 23-85 ppm excreted most of the retained dose in the urine (mainly as metabolites).

Guinea pigs that died from exposure had intense congestion of the lungs and generalized visceral hyperemia. Rats exposed for three days at 8700 mg/m^3 (2000 ppm) showed changes in the levels of dopamine and noradrenaline in various parts of the brain.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Two drops of the material in to the conjunctival sac produced only slight irritation of the conjunctival membrane but no corneal injury.

Skin: The liquid is discomforting to the skin if exposure is prolonged and is capable of causing skin reactions which may lead to dermatitis.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

The mean rate of absorption of liquid ethyl benzene applied to 17.3 cm2 area of the forearm of seven volunteers for 10-15 minutes was determined to be 38 mg/cm2/hr. Immersion of the whole hand in aqueous solutions of ethyl benzene (112-156 mg/l) for 1 hour yielded mean absorption rates of 118 and 215.7 ug/cm2/hr. The rate of absorption is thus greater than that of aniline, benzene, nitrobenzene, carbon disulfide and styrene.

Repeated application of the undiluted product to the abdominal area of rabbits (10-20 applications over 2-4 weeks) resulted in erythema, edema and superficial necrosis. The material did not appear to be absorbed through the skin in sufficient quantity to produce outward signs of toxicity.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.

The liquid may produce considerable gastrointestinal discomfort and may be harmful or toxic if swallowed. Ingestion may result in nausea, pain and vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Industrial workers exposed to a maximum level of ethyl benzene of 0.06 mg/l (14 ppm) reported headaches and irritability and tired quickly. Functional nervous system disturbances were found in some workers employed for over 7 years whilst other workers had enlarged livers.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Rinse mouth out with plenty of water. DO NOT induce vomiting.

Observe the patient carefully. Never give liquid to a person showing signs of being sleepy or with reduced awareness; i.e. becoming unconscious.

Give water (or milk) to rinse out mouth. Then provide liquid slowly and as much as casualty can comfortably drink.

Transport to hospital or doctor without delay.

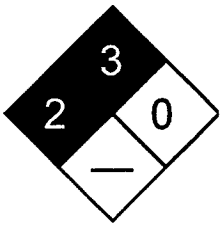
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to petroleum distillates or related hydrocarbons:

1. Primary threat to life from pure petroleum distillate ingestion and/or inhalation is respiratory failure.
2. Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
3. Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance
4. A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
5. Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
   Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
6. Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

Section 5 - Fire-Fighting Measures

Flash Point: 12.8 °C Closed Cup
Autoignition Temperature: 432 °C
LEL: 1.6% v/v
UEL: 7% v/v



Fire Diamond

Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.

General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
May emit clouds of acrid smoke.

Fire Incompatibility: Avoid contamination with oxidizing agents i.e. nitrates, oxidizing acids, chlorine bleaches, pool chlorine etc. as ignition may result.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.

Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.

If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear. Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves or Nitrile gloves.
Protective footwear.
Respiratory Protection:
Exposure Range >100 to <800 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 800 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black
Other: Overalls. Eyewash unit.
Glove Selection Index:

VITON	A
TEFLON	A

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid; floats on water. Aromatic solvent odor. Soluble in alcohol, benzene, carbon tetrachloride and ether.

Physical State: Liquid
Vapor Pressure (kPa): 1.333 at 25.9 °C
Vapor Density (Air=1): 3.66
Formula Weight: 106.17
Specific Gravity (H_2O=1, at 4 °C): 0.8670 at 20 °C
Water Solubility: 0.01% by weight
Evaporation Rate: Fast
pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 136.2 °C (277 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (rat) LD_{50}: 3500 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm/8h
Inhalation (rat) LC_{Lo}: 4000 ppm/4h
Intraperitoneal (mouse) LD_{50}: 2642 mg/kg~
Dermal (rabbit) LD_{50}: 17800 mg/kg~

IRRITATION
Skin (rabbit): 15 mg/24h mild
Eye (rabbit): 500 mg - SEVERE

Liver changes, utheral tract, effects on fertility, specific developmental abnormalities (musculoskeletal system) recorded.
NOTE: Substance has been shown to be mutagenic in various assays, or belongs to a family of chemicals producing damage or change to cellular DNA.

See NIOSH, *RTECS* DA 0700000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, it exist predominantly in the vapor phase based on its vapor pressure where it will photochemically degrade by reaction with hydroxyl radicals (half-life 0.5 to 2 days) and partially return to earth in rain. It will not be subject to direct photolysis. Releases into water will decrease in concentration by evaporation and biodegradation. The time for this decrease and the primary loss processes will depend on the season, and the turbulence and microbial populations in the particular body of water. Representative half-lives are several days to 2 weeks. Some may be adsorbed by sediment but significant bioconcentration in fish is not expected to occur based upon its octanol/water partition coefficient. It is only adsorbed moderately by soil. It will not significantly hydrolyze in water or soil.

Ecotoxicity: LC_{50} Cyprinodon variegatus (sheepshead minnow) 275 mg/l 96 hr in a static unmeasured bioassay; LC_{50} Pimephales promelas (fathead minnow) 12.1 mg/l/96 hr (confidence limit 11.5 - 12.7 mg/l), flow-through bioassay with measured concentrations, 26.1 °C, dissolved oxygen 7.0 mg/l, hardness 45.6 mg/l calcium carbonate, alkalinity 43.0 mg/l; Toxicity threshold (cell multiplication inhibition test): Pseudomonas putida (bacteria) 12 mg/l ; LC_{50} Palaemonetes pugio (grass shrimp, adult) 14,400 ug/l/24 hr in a static unmeasured bioassay; LC_{50} Palaemonetes pugio (grass shrimp, larva) 10,200 ug/l/24 hr in a static unmeasured bioassay; Toxicity threshold (cell multiplication inhibition test): Microcystis aeruginosa (algae) 33 mg/l; Scenedesmus quadricauda (green algae) > 160 mg/l

Henry's Law Constant: 8.44×10^{-3}

BCF: goldfish 1.9

Biochemical Oxygen Demand (BOD): theoretical 2.8%, 5 days

Octanol/Water Partition Coefficient: log $K_{ow} = 3.15$

Soil Sorption Partition Coefficient: $K_{oc} = 164$

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: ETHYLBENZENE
Additional Shipping Information: PHENYL ETHANE
Hazard Class: 3.1
ID No.: 1175
Packing Group: II
Label: Flammable Liquid [3]

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per CWA Section 307(a) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Genium Publishing Corp.
One Genium Plaza
Schenectady, NY 12304-4690
(518) 377-8854

Material Safety Data Sheet Collection

Diesel Fuel Oil No. 2-D MSDS No. 470

Date of Preparation: 10/81 Revision: B, 3/98

Section 1 - Chemical Product and Company Identification 51

Product/Chemical Name: Diesel fuel oil no. 2-D
Chemical Formula: Unspecified or variable
CAS Number: 68334-30-5
Synonyms: automotive diesel oil; diesel fuel; diesel oil (medium); diesel oil no. 2; diesel oil (petroleum); diesel oils; diesel test fuel; fuels, diesel; no. 2 diesel oil; olej napeldowy III (Polish)
Derivation: Fuel oil may be a distilled fraction of petroleum, a residuum from refinery operations, a crude petroleum or a blend of two or more of these.
General Use: This medium viscosity residual fuel oil has both light and heavy grades, and is used in furnaces and boilers of utility and industrial power plants, ships, locomotives, and metallurgical operations.
Vendors: Consult the latest *Chemical Week Buyers' Guide.* (73)

Section 2 - Composition / Information on Ingredients

Diesel fuel oil no. 2-D, ca 100% vol; diesel fuels consist primarily of aliphatic (64% vol), aromatic (35% vol), and olefinic (1-2% vol) hydrocarbons.
Trace Impurities: May contain sulfur (< 0.5), benzene (<100 ppm), and additives such as sulfurized esters.

OSHA PEL
As petroleum distillates
8-hr TWA: 500 ppm (2000 mg/m^3)

ACGIH TLV
As diesel fuel
Notice of impending change (1997):
TWA: 100 mg/m^3, *Skin*

NIOSH REL
As petroleum distillates
10-hr TWA: 350 mg/m^3
Ceiling (15 min): 1800 mg/m^3

IDLH Level
As petroleum distillates
1,100 ppm

DFG (Germany) MAK
None established

Section 3 - Hazards Identification

ANSI Signal Word: Caution

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Diesel fuel oil no. 2-D is a brown, slightly viscous liquid with a kerosene-like odor. It is irritating to the skin and respiratory tract. Inhalation of mist or vapor may result in headache, nausea, vomiting, diarrhea, central nervous system (CNS) depression, tachycardia (rapid heart beat), cyanosis (blue coloration of skin due to oxygen deficiency), pulmonary edema (fluid in the lungs), and liver or kidney injury. Diesel fuel oil no. 2-D is an environmental hazard when spilled. When exposed to heat or flame, this flammable liquid is a fire hazard. When heated to decomposition, diesel fuel oil no. 2-D will emit acrid smoke and irritating vapors.

Wilson Risk Scale
R 1
I 2
S 2*
K 2
*Skin absorption

HMIS
H 1*
F 2
R 0
PPE†
*Chronic effects
†Sec. 8

Potential Health Effects

Primary Entry Routes: Inhalation, ingestion, skin contact/absorption
Target Organs: Skin, CNS, cardiovascular system (CVS), respiratory system, liver, kidneys
Acute Effects
Inhalation: Euphoria, respiratory irritation, cardiac dysrhythmia, increased respiration rates, cyanosis, pulmonary edema, hemoptysis (spitting up blood from the respiratory tract), respiratory arrest, renal (kidney) and liver injury, and CNS toxicity can result from inhalation of diesel fuel oil no. 2-D mist or vapor.
Eye: Contact may result in irritation.
Skin: Contact may cause irritation, systemic effects (see Inhalation), and block the sebaceous (oil) glands, resulting in a rash of acne-like pimples and spots, usually on the arms and legs.
Ingestion: Gastrointestinal irritation, vomiting, diarrhea, and in severe cases, CNS depression progressing to coma and death and other systemic effects (see Inhalation) can result. Aspiration can result in transient CNS depression or excitement, hypoxia, infection, pneumatocele (abnormal cavities in lungs) formation, and chronic lung dysfunction.
Carcinogenicity: IARC lists occupational exposure in petroleum refining as Group 2A (Probable human carcinogen) and distillate light (diesel) fuels as Group 3 (Not classifiable as to carcinogenicity to humans). ACGIH lists a notice of impending change for diesel fuels as TLV-A3 (Animal carcinogen). NTP and OSHA do not list diesel fuel oil no. 2-D as a carcinogen.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Prolonged or repeated skin contact causes dermatitis and possible systemic toxicity. Prolonged or repeated inhalation can cause CNS and peripheral nervous system damage.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain and/or irritation develops.

Skin Contact: Quickly remove contaminated clothing. Rinse with flooding amounts of water followed by washing the exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Have the *conscious and alert* person drink 1 to 2 glasses of water. Contact a poison control center. Because of aspiration risk, *do not* induce vomiting unless the poison control center advises otherwise.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Gastric lavage is contraindicated due to aspiration risk. Instead, consider administration of charcoal or milk. If ingestion amount is large, gastric emptying in the alert patient can be accomplished through administration of Syrup of Ipecac. Treat overexposure symptomatically and supportively.

Section 5 - Fire-Fighting Measures

Flash Point: 100.4 °F (38 °C)

Flash Point Method: CC

Autoignition Temperature: 351-624 °F (177-329 °C)

LEL: 1.3% v/v

UEL: 75% v/v

NFPA

Flammability Classification: OSHA Class II Combustible Liquid

Extinguishing Media: Use dry chemical, carbon dioxide, foam, low velocity water fog or spray. Use a smothering technique to extinguish fire. Water may be ineffective in putting out a fire involving diesel fuel oil no. 2-D, and a solid water stream may spread the flames; however, a water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.

Unusual Fire or Explosion Hazards: Vapor or mist can form explosive mixtures in air. In still air, the heavier-than-air vapors of diesel fuel oil no. 2-D from a large source may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Hazardous Combustion Products: Heating diesel fuel oil no. 2-D to decomposition can produce acrid smoke and irritating vapors.

Fire-Fighting Instructions: *Do not* release runoff from fire control methods to sewers or waterways.

Fire-Fighting Equipment: Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill /Leak Procedures: Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A fire fighting foam may be used to suppress vapors. Absorb or cover with dry earth, sand or other non-combustible material and transfer to containers. Use clean non-sparking tools to collect absorbed material.

Small Spills: Absorb diesel fuel oil no. 2-D with vermiculite, earth, sand or similar material.

Large Spills

Containment: For large spills, consider downwind evacuation of at least 1000 ft (300 m). Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Cleanup: Ground all equipment. Use non-sparking tools. Spills can be absorbed with materials such as peat, activated carbon, polyurethane foam, or straw. Sinking agents, gelling agents, dispersants, and mechanical systems can also be use to treat oil spills.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor or mist inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves (or use barrier cream), and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

Storage Requirements: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Periodically inspect stored materials. Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.106) for Class II Combustible Liquid.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations.

Ventilation: Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local exhaust ventilation appropriately designed for flammable mist and vapor at the site of chemical release. Where possible, transfer diesel fuel oil no. 2-D from drums or other storage containers directly to process containers. Minimize sources of ignition in surrounding low-lying areas.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), use an SCBA.
Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres. If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets. Wear protective eyeglasses, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Safety Stations: Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Contaminated Equipment: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment.

Comments: Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Section 9 - Physical and Chemical Properties

Physical State: Liquid
Appearance and Odor: Brown, slightly viscous; kerosene-like odor
Odor Threshold: 0.7 ppm
Vapor Pressure: < 0.1 mm Hg at 68 °F (20 °C)
Vapor Density (Air=1): > 6
Formula Weight: N/A

Specific Gravity (H_2O=1, at 4 °C): < 0.86
Water Solubility: Insoluble
Boiling Point: 340-676 °F (171-358 °C)
Freezing Point: -29.2 °F (-34 °C)
Viscosity: 1.9-4.1 centistoke at 104 °F (40 °C)
Surface Tension: 23-32 dynes/cm at 68 °F (20 °C)

Section 10 - Stability and Reactivity

Stability: Diesel fuel oil no. 2-D is stable at room temperature in closed containers under normal storage and handling conditions.

Polymerization: Hazardous polymerization cannot occur.

Chemical Incompatibilities: Include strong oxidizing agents.

Conditions to Avoid: Exposure to heat and ignition sources.

Hazardous Decomposition Products: Thermal oxidative decomposition of diesel fuel oil no. 2-D can produce low molecular weight hydrocarbons, hydrocarbon derivatives, carbon oxides (CO_x), and sulfur oxides (SO_x).

Section 11- Toxicological Information

Toxicity Data:*

Acute Oral Effects:
Rat, oral, LD_{50}: 7500 mg/kg

Acute Dermal Effects:
Rabbit, skin, LD: > 5 mL/kg

Skin Effects:
Rabbit, skin, standard Draize test: 500 µL/24 hr, resulted in severe reaction.

Other Multiple Dose Toxicity Data:
Rat, inhalation: 2 g/m3/6 hr/3 weeks, intermittently, resulted in changes in blood erythrocyte (RBC) count, and focal fibrosis (pneumonoconiosis) and other changes in the lung, thorax or respiration.
Rat, inhalation: 400 µg/m3/16 hr/2.5 years, intermittently, caused other changes in the blood, and biochemical effects - transaminases.
Rabbit, skin: 80 mL/kg/12 days, continuously, resulted in other changes in the liver, kidney, ureter, and bladder, and death.

* See NIOSH, *RTECS* (HZ1800000), for additional toxicity data.

Section 12 - Ecological Information

Ecotoxicity: Juvenile American shad, salt water TLm: 204 mg/L/24 hr; mallard duck, LD_{50}=20 mg/kg.

Environmental Fate: Diesel fuel oil no. 2-D will evaporate from water or soil. In surface water, it may partition from the water column to suspended sediments.

Environmental Degradation: Biodegradation may occur in soil and water.

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Diesel fuel
Shipping Symbols: D
Hazard Class: 3
ID No.: NA1993
Packing Group: III
Label: None
Special Provisions (172.102): B1

Packaging Authorizations
a) Exceptions: 173.150
b) Non-bulk Packaging: 173.203
c) Bulk Packaging: 173.242

Quantity Limitations
a) Passenger, Aircraft, or Railcar: 60 L
b) Cargo Aircraft Only: 220 L

Vessel Stowage Requirements
a) Vessel Stowage: A
b) Other: –

Section 15 - Regulatory Information

EPA Regulations:

Classified as RCRA Hazardous Waste (40 CFR 261.21): Characteristic of Ignitability
RCRA Hazardous Waste Number: D001
Listed as a CERCLA Hazardous Substance (40 CFR 302.4), Unlisted Hazardous Waste, Characteristic of Ignitability per RCRA Sec. 3001
CERCLA Final Reportable Quantity (RQ): 100 lb (45.4 kg)
SARA Toxic Chemical (40 CFR 372.65): Not listed
SARA EHS (Extremely Hazardous Substance) (40 CFR 355): Not listed

OSHA Regulations:

Listed as an Air Contaminant (29 CFR 1910.1000, Table Z-1-A, as petroleum distillates)

Section 16 - Other Information

References: 73, 103, 136, 190, 209, 222, 230, 231

Prepared By..... HM Spliethoff, MS
Industrial Hygiene Review..... PA Roy, MPH, CIH
Medical Review..... T Thoburn, MD, MPH

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Methanol
MET1440

Section 1 - Chemical Product and Company Identification 51/57

Material Name: Methanol
CAS Number: 67-56-1
Chemical Formula: CH_4O
Structural Chemical Formula: CH_3OH
EINECS Number: 200-659-6
Synonyms: ALCOHOL,METHYL; ALCOOL METHYLIQUE; ALCOOL METILICO; CARBINOL; X-CIDE 402 INDUSTRIAL BACTERICIDE; COAT-B1400; COLONIAL SPIRIT; COLONIAL SPIRITS; COLUMBIAN SPIRIT; COLUMBIAN SPIRITS; EPA PESTICIDE CHEMICAL CODE 053801; EUREKA PRODUCTS CRIOSINE DISINFECTANT; EUREKA PRODUCTS,CRIOSINE; FREERS ELM ARRESTER; IDEAL CONCENTRATED WOOD PRESERVATIVE; METANOL; METANOLO; METHANOL; METHYL ALCOHOL; METHYL HYDRATE; METHYL HYDROXIDE; METHYLALKOHOL; METHYLOL; METYLOWY ALKOHOL; MONOHYDROXYMETHANE; PMC REJEX-IT F-40ME; PYROLIGNEOUS SPIRIT; PYROXYLIC SPIRIT; PYROXYLIC SPIRITS; SURFLO-B17; WILBUR-ELLIS SMUT-GUARD; WOOD ALCOHOL; WOOD NAPHTHA; WOOD SPIRIT
Derivation: Prepared by wood pyrolysis; non-catalytic oxidation of hydrocarbons; as a by-product in the fisher-tropsch synthesis; or by reduction of carbon monoxide.
General Use: Used as an industrial solvent; starting material for organic synthesis; antifreeze for windshield washer fluid; in fuel antifreezes; gasoline octane booster; fuel for stoves; extractant for oils; denaturing ethanol; softening agent; food additive; in paint, varnish removers, and embalming fluids; in the manufacture of photographic film, celluloid, textile soap, wood stains, coated fabrics, shatterproof glass, paper coating, waterproofing formulations, artificial leather, dyes.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Methanol	67-56-1	ca 100% vol

Trace Impurities: (Grade A): Acetone and aldehydes < 30 ppm, acetic acid < 30 ppm

OSHA PEL
TWA: 200 ppm; 260 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 200 ppm; 260 mg/m^3;
STEL: 250 ppm; 325 mg/m^3.

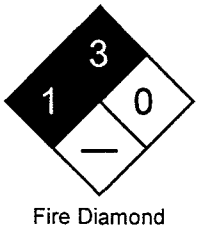
ACGIH TLV
TWA: 200 ppm, 262 mg/m^3;
STEL: 250 ppm, 328 mg/m^3; skin.

NIOSH REL
TWA: 200 ppm, 260 mg/m^3;
STEL: 250 ppm, 325 mg/m^3;
skin.

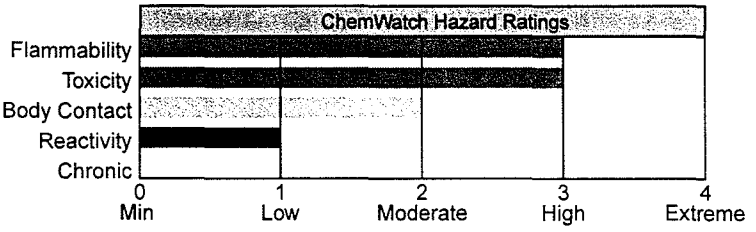
IDLH Level
6000 ppm.

DFG (Germany) MAK
TWA: 200 ppm, 270 mg/m^3; skin, ceiling, substances with systemic effects, onset of effects within 2 hours, half-life two hours to shift length.

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Methanol is a colorless liquid with a slight alcohol odor when pure, or disagreeably pungent odor when crude. It is irritating to the eyes, skin, and respiratory tract. Exposure may result in headache, visual disturbance, blindness, and respiratory failure. Reproductive effects have been reported in animal testing. This flammable liquid is a moderate explosion hazard. When heated to decomposition, methanol emits carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Potential Health Effects

Target Organs: Eyes, skin, central nervous system (CNS), gastrointestinal (GI) tract, respiratory system

Primary Entry Routes: Inhalation, ingestion, skin and/or eye contact/absorption

Acute Effects

Inhalation: Irritation, breathing difficulty, headache, drowsiness, vertigo, light-headedness, nausea, vomiting, acidosis (decreased blood alkalinity), visual disturbance, and at high concentrations, CNS damage, convulsions, circulatory collapse, respiratory failure, coma and blindness can result from inhalation of methanol vapor. Concentration >= 200 ppm may cause headache; 50,000 ppm can cause death within 1-2 hrs.

Eye: Contact with liquid may result in irritation, inflamed lids, light sensitization, and superficial lesions.

Skin: Contact may cause irritation, dermatitis, swelling, scaling, and systemic effects listed under inhalation.

Ingestion: GI irritation and systemic effects (see Inhalation). Symptoms may be delayed 18-48 hours. Fatal dose - 2 to 8 ounces.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: None reported.

Chronic Effects: Exposure to methanol vapors has caused conjunctivitis, headache, giddiness, insomnia, GI disturbance, impaired vision. CNS damage is also likely. Methanol is slowly eliminated from the body; exposure is considered cumulative over the short term.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 minutes. Consult a physician or ophthalmologist if pain or irritation develops.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area with soap and water. For reddened or blistered skin, consult a physician.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Follow emesis with rehydration, correction of acidosis, and folate to enhance formate oxidation. Consider IV administration of ethanol (if blood methanol >20 mg/dL) to show metabolic oxidation of methanol. Assay formic acid in urine, blood pH and plasma bicarbonate.

Section 5 - Fire-Fighting Measures

Flash Point: 54 °F (12 °C), Closed Cup

Burning Rate: 1.7 mm/min

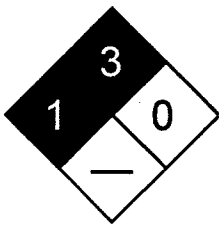
Autoignition Temperature: 867 °F (464 °C)

LEL: 6.0% v/v

UEL: 36% v/v

Flammability Classification: OSHA Class IB Flammable Liquid.

Extinguishing Media: Use dry chemical, carbon dioxide, water spray, fog or alcohol-resistant foam. A water spray may be used to cool fire-exposed containers, and flush spills away from ignition sources.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Heating methanol to decomposition can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes. Can form explosive mixtures in the air. The heavier-than-air vapors of methanol may travel along low-lying surfaces to distant sources of ignition and flash back to the material source. Containers may explode in heat of fire.

Fire-Fighting Instructions: *Do not* scatter material with any more water than needed to extinguish fire. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Isolate spill area for at least 330-660 feet (100-200 m) in all directions. Fully encapsulating, vapor protective clothing should be worn for spills and leaks with no fire. Eliminate all ignition sources (no smoking, flares, sparks or flames in immediate area). Ground all equipment used when handling this product. *Do not* touch or walk through spilled material. Stop leak if you can do it without risk. Prevent entry into waterways, sewers, basements or confined areas. A vapor suppressing foam may be used to reduce vapors.

Small Spills: Absorb with earth, sand or other non-combustible material and transfer to containers for later disposal. Use clean non-sparking tools to collect absorbed material.

Large Spills: Dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways. Ground all equipment. Use non-sparking tools.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid vapor inhalation, and skin and eye contact. Use only with ventilation sufficient to reduce airborne concentrations to non-hazardous levels (see Sec. 2). Wear protective gloves, goggles, and clothing (see Sec. 8). Keep away from heat and ignition sources. Ground and bond all containers during transfers to prevent static sparks. Use non-sparking tools to open and close containers.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed container in cool, well-ventilated area, away from heat, ignition sources and incompatibles (see Sec. 10). Equip drums with self-closing valves, pressure vacuum bungs, and flame arrestors.

Regulatory Requirements: Follow applicable OSHA regulations. Also 29 CFR 1910.106 for Class 1B Flammable Liquids.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: To prevent static sparks, electrically ground and bond all containers and equipment used in shipping, receiving, or transferring operations. Provide general or local exhaust ventilation systems to maintain airborne concentrations as low as possible. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Enclose operations and/or provide local explosion-proof exhaust ventilation at the site of chemical release. Where possible, transfer methanol from drums or other storage containers to process containers. Minimize sources of ignition in surrounding areas.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets of butyl rubber, Teflon, Viton, Saranex, 4H, Responder, Trellchem HPS, or Tychem 10000 (Breakthrough Time (BT) >8 hr) to prevent skin contact. Natural rubber, neoprene, nitrile rubber, polyethylene, polyvinyl alcohol and CPF 3 may degrade after contact and are not recommended. Wear splash-proof chemical safety goggles, and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/ NIOSH-approved respirator. For concentrations <= 2000 ppm, use a supplied air respirator; <= 5000 ppm, supplied air (SA) respirator in continuous flow mode; <= 6000 ppm, SA respirator with tight-fitting face mask operated in continuous flow mode, or SCBA with full facepiece, or SA respirator with full facepiece; > IDLH/unknown/emergency, SCBA with full facepiece operated in pressure-demand or other positive-pressure mode, or SA respirator with full facepiece operated in pressure-demand or other positive-pressure mode in combination with auxiliary SCBA operated in pressure-demand or other positive-pressure mode. For escape, use an appropriate escape-type SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen- deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: Colorless; slight alcohol odor when pure, disagreeably pungent odor when crude.

Physical State: Liquid

Vapor Pressure (kPa): 127 mm Hg at 77 °F (25 °C)

Vapor Density (Air=1): 1.11

Bulk Density: 6.59 lbs/gal at 68 F (20 °C)

Formula Weight: 32.04

Density: 0.796 g/mL at 59 °F (15 °C)

Specific Gravity (H_2O=1, at 4 °C): 0.81 at 0 °C/4 °C

Refractive Index: 1.3292 at 68 °F (20 °C)

pH: Slightly acidic

Boiling Point: 148 °F (64.7 °C) at 760 mm Hg

Freezing/Melting Point: -144.04 °F (-97.8 °C)
Viscosity: 0.614 mPa sec
Surface Tension: 22.61 dynes/cm
Ionization Potential (eV): 10.84 eV
Water Solubility: Miscible
Other Solubilities: Ethanol, acetone, benzene, chloroform, DMSO, ether, ketones, most organic solvents.

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Methanol is stable at room temperature in closed containers under normal storage and handling conditions. Hazardous polymerization cannot occur. Vapor inhalation, oxidizers.

Storage Incompatibilities: Include beryllium dihydride, metals (potassium, magnesium), oxidants (barium perchlorate, bromine, chlorine, hydrogen peroxide, sodium hypochlorite, phosphorus trioxide), potassium tertbutoxide, carbon tetrachloride and metals, chloroform and heat, diethyl zinc, alkyl aluminum salts, acetyl bromide, chloroform and sodium hydroxide, cyanuric chloride, nitric acid, chromic anhydride, lead perchlorate.

Hazardous Decomposition Products: Thermal oxidative decomposition of methanol can produce carbon oxides (CO_x), formaldehyde, acrid smoke, and irritating fumes.

Section 11 - Toxicological Information

Acute Oral Effects:

Rat, oral, LD_{50}: 5628 mg/kg.

Human, oral, LD_{Lo}: 428 mg/kg produced toxic effects: behavioral - headache; lungs, thorax, or respiration - other changes.

Human, oral, LD_{Lo}: 143 mg/kg produced optic nerve neuropathy, dyspnea, nausea or vomiting.

Acute Inhalation Effects:

Rat, inhalation, LC_{50}: 64000 ppm/4 hr.

Human, inhalation, TC_{Lo}: 300 ppm produced visual field changes, headache; lungs, thorax, or respiration - other changes.

Acute Skin Effects:

Rabbit, skin, LD_{50}: 15800 mg/kg.

Monkey, skin, LD_{Lo}: 393 mg/kg.

Irritation Effects:

Rabbit, standard Draize test: 100 mg/24 hr resulted in moderate irritation.

Rabbit, standard Draize test: 20 mg/24 hr resulted in moderate irritation.

Other Effects:

Rat, oral: 10 µmol/kg resulted in DNA damage.

Rat, inhalation: 50 mg/m^3/12 hr/13 weeks intermittently produced degenerative changes to brain and coverings; muscle contraction or spasticity.

Rat, inhalation: 2610 ppm/6 hr/4 weeks intermittently produced toxic effects: endocrine - changes in spleen weight.

Multiple Dose Toxicity Effects - Rat, oral: 12 g/kg/8 weeks intermittently produced toxic effects: behavioral - ataxia; behavioral - alteration of operant conditioning.

Human, lymphocyte: 300 mmol/L resulted in DNA inhibition.

Rat (female), oral: 7500 mg/kg, administered during gestational days 17-19 produced effects on newborn - behavioral.

Rat (female), oral: 35295 mg/kg administered during gestational days 1-15 produced effects on the fertility index; pre implantation mortality; and post-implantation mortality.

Rat (female), inhalation: 20000 ppm/7 hr, administered during gestational days 1-22 produced specific developmental abnormalities - musculoskeletal system; cardiovascular (circulatory) system; urogenital system.

Rat (male), oral: 200 ppm/20 hr, 78 weeks prior to mating produced paternal effects - testes, epididymis, sperm duct.

See NIOSH, *RTECS* PC1400000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Bioconcentration (BCF, estimated at 0.2) is not expected to be significant. Physical removal from air can occur via rainfall. Relatively rapid evaporation from dry surfaces is likely to occur. If released to the atmosphere, it degrades via reaction with photochemically produced hydroxyl radicals with an approximate half-life of 17.8 days. If released to water or soil, biodegradation is expected to occur. A low K_{oc} indicates little sorption and high mobility in the soil column.

Ecotoxicity: Trout, LC_{50}: 8,000 mg/L/48 hr; *Pimephales promelas* (fathead minnow) LC_{50}: 29.4 g/L/96 hr.

Henry's Law Constant: 4.55 x10^{-6} atm-m^3/mole at 77 °F (25 °C)

Octanol/Water Partition Coefficient: log K_{ow} = -0.77

Soil Sorption Partition Coefficient: K_{oc} = 0.44

Section 13 - Disposal Considerations

Disposal: Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Methanol
Hazard Class: 3
ID No.: UN1230
Packing Group: II
Label: FLAMMABLE LIQUID

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Listed U154 Ignitable Waste
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2003-02

Section 1 - Chemical Product and Company Identification 50/57

Material Name: Naphthalene **CAS Number:** 91-20-3
Chemical Formula: $C_{10}H_8$
EINECS Number: 202-049-5
Synonyms: ALBOCARBON; CAMPHOR TAR; DEZODORATOR; FAULDING NAPHTHALENE FLAKES; MIGHTY 150; MIGHTY RD1; MOTH BALLS; MOTH FLAKES; MOTHBALLS; NAFTALEN; NAPHTHALENE; NAPHTHALIN; NAPHTHALINE; NAPHTHENE; TAR CAMPHOR; WHITE TAR
Derivation: From coal tar; from petroleum fractions after various catalytic processing operations.
General Use: Used as a moth repellent, an antiseptic, toilet bowl deodorant, heat transfer agent, fungicide, smokeless powder, cutting fluid, lubricant, wood preservative; an intermediate for naphthol, phthalic anhydride, chlorinated naphthalenes, Tertralin, Decalin, naphthyl and naphthol derivatives, and dyes; in synthetic resins, synthetic tanning, textile chemicals, scintillation counters, and emulsion breakers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
Naphthalene	91-20-3	ca 100% wt.

Grade - By melting point, 165 °F (74 °C) min (crude) to greater than 174 °F (79 °C) (refined); scintillation 176-177 °F (80-81 °C)

OSHA PEL
TWA: 10 ppm; 50 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 10 ppm; 50 mg/m^3; STEL: 15 ppm; 75 mg/m^3.

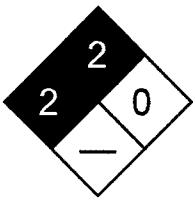
ACGIH TLV
TWA: 10 ppm, 52 mg/m^3; STEL: 15 ppm, 79 mg/m^3; skin.

NIOSH REL
TWA: 10 ppm, 50 mg/m^3; STEL: 15 ppm, 75 mg/m^3.

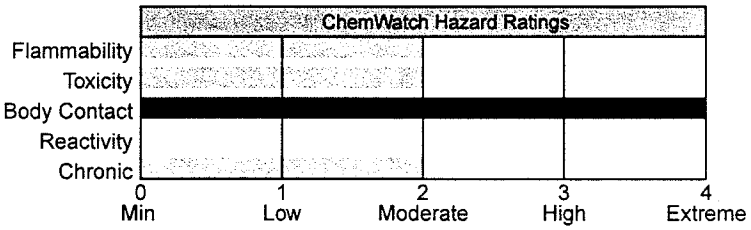
IDLH Level
250 ppm.

DFG (Germany) MAK
Skin

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Warning!

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Naphthalene is a white crystalline solid with a 'moth ball' or coal-tar odor. It is toxic by ingestion. Irritating to skin, eyes, and respiratory system. Naphthalene is a combustible solid. Dust may form explosive mixtures in air if subjected to an ignition source.

Potential Health Effects

Target Organs: Blood (red blood cell effects), eyes, skin, central nervous system (CNS), liver and kidneys
Primary Entry Routes: Inhalation, skin absorption, skin and/or eye contact
Acute Effects
Inhalation: Vapor inhalation causes headache, confusion, nausea, sometimes vomiting, loss of appetite, extensive sweating, dysuria (painful urination), hematuria (blood in the urine), and hemolysis (destruction of red blood cells).
Eye: Irritation, conjunctivitis, and corneal injury upon prolonged contact.
Skin: Irritation and hypersensitivity dermatitis.

Ingestion: Unlikely. However, ingestion causes irritation of the mouth and stomach, hemolytic anemia with hepatic and renal lesions and vesical congestion, kidney failure, hematuria, jaundice, depression of CNS, nausea, vomiting, abdominal pain, blue face, lips, or hands, rapid and difficult breathing, headache, confusion, excitement, malaise, fever, perspiration, urinary tract pain, dizziness, convulsions, coma, and death. Symptoms may appear 2 to 4 hours after exposure.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Medical Conditions Aggravated by Long-Term Exposure: Diseases of the blood, liver and kidneys; individuals with a hereditary deficiency of the enzyme glucose-6-phosphate dehydrogenase in red blood cells are particularly susceptible to the hemolytic properties of naphthalene metabolites.

Chronic Effects: May cause optical neuritis, corneal injuries, cataracts, kidney damage. There are two reports of naphthalene crossing the placenta in humans.

Section 4 - First Aid Measures

Inhalation: Remove exposed person to fresh air and support breathing as needed. Contact a physician immediately if symptoms of systemic poisoning are present.

Eye Contact: *Do not* allow victim to rub or keep eyes tightly shut. Gently lift eyelids and flush immediately and continuously with flooding amounts of water for at least 15 min. Consult a physician or ophthalmologist if pain, irritation, swelling, or photophobia persist.

Skin Contact: *Quickly* remove contaminated clothing. Rinse with flooding amounts of water for at least 15 min. Wash exposed area thoroughly with soap and water. For reddened or blistered skin, consult a physician. Contact a physician immediately if symptoms of systemic poisoning are present.

Ingestion: Never give anything by mouth to an unconscious or convulsing person. Contact a poison control center. Unless the poison control center advises otherwise, have the *conscious and alert* person drink 1 to 2 glasses of water, then induce vomiting. Contact a physician immediately.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Obtain baseline CBC, electrolytes, liver and renal function rests, glucose-6-phosphatase dehydrogenase level, urinalysis, and benzidine dipstick to check for hemoglobinuria. Urinary metabolite, 1-naphthol or mercapturic acid, may help confirm the diagnosis.

Section 5 - Fire-Fighting Measures

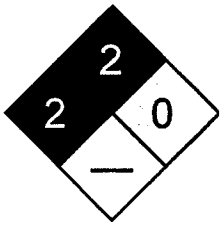
Flash Point: 174 °F (79 °C) OC; 190 °F (88 °C) CC

Autoignition Temperature: 979 °F (526 °C)

LEL: 0.9% v/v

UEL: 5.9% v/v

Flammability Classification: Combustible solid



Fire Diamond

Extinguishing Media: Use dry chemical, foam, carbon dioxide (CO_2), or water spray. Water or foam may cause frothing. Use water spray to keep fire-exposed containers cool.

General Fire Hazards/Hazardous Combustion Products: Toxic vapors including carbon monoxide. Volatile solid that gives off flammable vapors when heated. Dust may explode in air if an ignition source is provided.

Fire-Fighting Instructions: Move containers from the fire area if it can be done without risk. Otherwise cool fire-exposed containers until well after the fire is extinguished. *Do not* release runoff from fire control methods to sewers or waterways. Because fire may produce toxic thermal decomposition products, wear a self-contained breathing apparatus (SCBA) with a full facepiece operated in pressure-demand or positive-pressure mode. Wear full protective clothing (see Sec. 8). Structural clothing is permeable, remain clear of smoke, water fall out, and water run off.

Section 6 - Accidental Release Measures

Spill/Leak Procedures: Notify safety personnel, evacuate all unnecessary personnel, remove heat and ignition sources. Isolate and ventilate area, deny entry, stay upwind. Stop leak if you can do it without risk. Use spark-proof tools and explosion proof equipment. Cleanup personnel should wear personal protective equipment to protect against exposure (see Sec. 8).

Small Spills: *Do not* sweep! Carefully scoop up or vacuum (with a HEPA filter). Absorb liquid spill with an inert, noncombustible absorbent such as sand or vermiculite.

Large Spills: For large spills, dike far ahead of liquid spill for later disposal. *Do not* release into sewers or waterways.

Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: To avoid vapor inhalation use only with ventilation sufficient to reduce airborne concentrations to nonhazardous levels. Avoid skin and eye contact. Wear personal protective clothing and equipment to prevent any contact with skin and eyes (see Sec. 8). Practice good personal hygiene procedures to prevent inadvertently ingesting this material.

Never eat, drink, or smoke in work areas. Practice good personal hygiene after using this material, especially before eating, drinking, smoking, using the toilet, or applying cosmetics.

Recommended Storage Methods: Store in tightly closed, explosion-proof containers in a cool, well-ventilated area away from heat, ignition sources, and incompatibles (see Sec. 10). May be stored under nitrogen gas. Protect containers against physical damage. Use monitoring equipment to measure the extent of vapor present in any storage facility containing naphthalene because of potential fire and explosion hazards.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Where feasible, enclose operations to avoid vapor and dust dispersion into the work area. Ventilate at the site of chemical release. During the fractional distillation of naphthalene and in any operation entailing the heating or volatilization of naphthalene, enclosed apparatus should be employed. Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs (Sec. 2). Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work area by controlling it at its source.

Administrative Controls: Educate workers about the health and safety hazards associated with naphthalene. Train in work practices which minimize exposure. Consider preplacement and periodic medical exams with emphasis on the eyes, skin, liver, kidneys, CBC (RBC count, WBC count, differential count of a stained smear, hemoglobin, and hematocrit), and urinalysis including at a minimum specific gravity, albumin, glucose, and a microscopic examination on centrifuged sediment.

Personal Protective Clothing/Equipment: Wear chemically protective gloves, boots, aprons, and gauntlets to prevent skin contact. Teflon is recommended. *Do not* use butyl rubber, natural rubber, neoprene or polyvinyl chloride. Wear chemical dust-proof safety goggles and face shield, per OSHA eye- and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with contact lenses.

Respiratory Protection: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA/NIOSH-approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or nonroutine operations (cleaning spills, reactor vessels, or storage tanks), wear an SCBA. *Warning! Air-purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit-testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

Other: Separate contaminated work clothes from street clothes. Launder before reuse. Remove naphthalene from your shoes and clean personal protective equipment. Make emergency eyewash stations, safety/quick-drench showers, and washing facilities available in work area.

Section 9 - Physical and Chemical Properties

Appearance/General Info: White volatile flakes, cakes, cubes, spheres, or powder; strong coal-tar or moth ball odor.

Physical State: Crystalline solid

Odor Threshold: 0.084 ppm to 0.3 ppm

Vapor Pressure (kPa): 0.05 mm Hg at 68 °F (20 °C); 1.0 mm Hg at 127 °F (53 °C)

Formula Weight: 128.2

Density: 1.145 g/cm^3 at 68 °F (20 °C)

Boiling Point: 424 °F (218 °C)

Freezing/Melting Point: 176 °F (80.2 °C)

Water Solubility: Insoluble [31.7 mg/L at 68 °F (20 °C)]

Other Solubilities: Benzene, absolute alcohol; very soluble in ether, chloroform, carbon disulfide, hydronaphthalenes, fixed and volatile oils

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Naphthalene is stable at room temperature in closed containers under normal storage and handling conditions. It volatilizes at room temperature. Hazardous polymerization cannot occur. Exposure to heat and ignition sources, incompatibles.

Storage Incompatibilities: Include aluminum chloride, benzoyl chloride, chromic acid, chromium trioxide, oxidizers. Explosive reaction with dinitrogen pentaoxide. Melted naphthalene will attack some forms of plastics.

Hazardous Decomposition Products: Thermal oxidative decomposition of naphthalene can produce toxic fumes including carbon monoxide.

Section 11 - Toxicological Information

Acute Oral Effects:\
Rat, oral, LD_{50}: 490 mg/kg.\
Mouse, oral, LD_{50}: 533 mg/kg.\
Human (child), oral, LD_{Lo}: 100 mg/kg.\
Acute Inhalation Effects:\
Rat, inhalation, LC_{50}: >340 mg/m^3 produced lacrimation and somnolence.\
Irritation Effects:\
Rabbit, eye, standard Draize test: 100 mg produced mild irritation.\
Rabbit, skin, open Draize test: 495 mg produced mild irritation.\
Other Effects:\
Rat, oral: 4500 mg/kg administered on gestational days 6-15 produced fetotoxicity and other developmental abnormalities. \
Man, unreported, LD_{Lo}: 74 mg/kg.\
Mouse, inhalation: 30 ppm/6 hr/2 yr administered intermittently produced toxic effects: tumorigenic - neoplastic by RTECS criteria; lungs, thorax, or respiration - tumors.\
Hamster, ovary: 15 mg/L induced sister chromatid exchange.

See NIOSH, *RTECS* QJ0525000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to the atmosphere, naphthalene rapidly photodegrades with a half-life of 3-8 hr. Volatilization, photolysis, adsorption, and biodegradation are important loss mechanisms for naphthalene discharged into water. Depending on local conditions, the half-lives range from a couple of days to a few months. If released on land, it is adsorbed moderately to soil, undergoes biodegradation; but in some cases biodegradation may still occur if conditions are aerobic. Bioconcentration occurs to a moderate extent, but is a temporary problem since depuration and metabolism readily proceed in aquatic organisms.

Ecotoxicity: *Oncorhynchus gorbuscha* (pink salmon): 1.37 ppm/96 hr at 39 °F (4 °C). *Pimephales promelas* (fathead minnow): 7.76 mg/L/24 hr.

Octanol/Water Partition Coefficient: log K_{ow} = 3.30

Section 13 - Disposal Considerations

Disposal: Consider rotary kiln or fluidized bed incineration. Contact your supplier or a licensed contractor for detailed recommendations. Follow applicable Federal, state, and local regulations. Handle empty containers carefully as hazardous residues may still remain.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: Naphthalene, crude or Naphthalene, refined\
Hazard Class: 4.1\
ID No.: UN1334\
Packing Group: III\
Label: FLAMMABLE SOLID

Section 15 - Regulatory Information

EPA Regulations:\
RCRA 40 CFR: Listed U165 Toxic Waste\
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4), per RCRA Section 3001, per CWA Section 307(a) 100 lb (45.35 kg)\
SARA 40 CFR 372.65: Listed\
SARA EHS 40 CFR 355: Not listed\
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2002-02

n-Hexane
HEX6400

Section 1 - Chemical Product and Company Identification 54

Material Name: n-Hexane **CAS Number:** 110-54-3
Chemical Formula: C_6H_{14}
Structural Chemical Formula: $H_3C(CH_2)_4CH_3$
Synonyms: DIPROPYL; ESANI; GETTYSOLVE-B; HEKSAN; HEXANE; N-HEXANE; N-HEXANE; HEXANEN; HEXYL HYDRIDE; NORMAL HEXANE; NORMAL-HEXANE; SKELLYSOLVE-B; SKELLYSOLVE B
General Use: An incidental component of many aliphatic solvent mixes used as lacquer, paint and enamel thinners, also in ink reducers and cleaning solvents.
Also used for solvent extraction of oil seeds and in pesticide residue analysis and gas chromatography.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
n-hexane	110-54-3	> 95

OSHA PEL
TWA: 500 ppm; 1800 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 50 ppm; 180 mg/m^3.

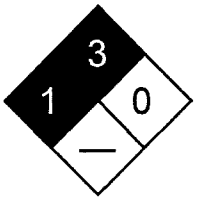
ACGIH TLV
TWA: 50 ppm, 176 mg/m^3; skin.

NIOSH REL
TWA: 50 ppm, 180 mg/m^3.

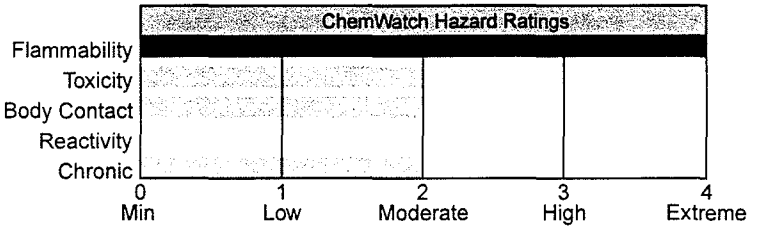
IDLH Level
1100 ppm; 10% LEL.

DFG (Germany) MAK
TWA: 50 ppm, 180 mg/m^3; PEAK: 400 ppm, 1440 mg/m^3; skin, ceiling, substances with systemic effects, onset of effect within 2 hours.

Section 3 - Hazards Identification



Fire Diamond



ANSI Signal Word

Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless, volatile liquid; sweet/gasoline odor. Irritating to eyes/skin/respiratory tract. Also causes: dizziness, fatigue, muscle weakness, hallucinations. Chronic: peripheral neuropathy (muscle weakness, motor loss, sensory disturbances). Flammable.

Potential Health Effects

Target Organs: eyes, skin, respiratory system, central nervous system (CNS), peripheral nervous system
Primary Entry Routes: inhalation, skin contact/absorption, eyes, ingestion
Acute Effects
Inhalation: The vapor is discomforting and harmful to the upper respiratory tract.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.
If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.
Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.
The vapor is irritating to the eyes and may cause smarting, painand redness.

The material may be irritating to the eye, with prolonged contact causing inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid is discomforting to the skin and is capable of causing skin reactions which may lead to dermatitis. Toxic effects may result from skin absorption.

Ingestion: The liquid is highly discomforting and harmful if swallowed.
Ingestion may result in nausea, pain, vomiting. Vomit entering the lungs by aspiration may cause potentially lethal chemical pneumonitis.
Considered an unlikely route of entry in commercial/industrial environments.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Chronic inhalation or skin exposure to n-hexane may cause peripheral neuropathy, which is damage to nerve ends in extremities, e.g. fingers, with loss of sensation and characteristic thickening. Nerve damage has been documented with chronic exposures of greater than 500 ppm.
Improvement in condition does not immediately follow removal from exposure and symptoms may progress for two or three months. Recovery may take a year or more depending on severity of exposure, and may not always be complete.
Exposure to n-hexane with methyl ethyl ketone (MEK) will accelerate the appearance of damage, but MEK alone will not cause the nerve damage.
Other isomers of hexane do not cause nerve damage.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).
Wash affected areas thoroughly with water (and soap if available).
Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.
Do NOT induce vomiting. Give a glass of water.

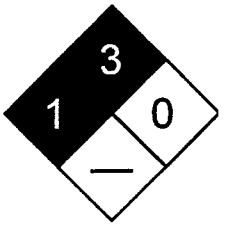
After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to n-hexane:
1.Large quantities of n-hexane are expired by the lungs after vapor exposure (50-60%). Humans exposed to 100 ppm demonstrate an n-hexane biological half life of 2 hours.
2. Initial attention should be directed towards evaluation and support of respiration. Cardiac dysrhythmias are a potential complication.
INGESTION:
1.Ipecac syrup should be considered for ingestion of pure hexane exceeding 2-3 mL/kg. Extreme caution must be taken to avoid aspiration since small amounts of n-hexane intratracheally, produce a severe chemical pneumonitis
BIOLOGICAL EXPOSURE INDEX - BEI
BEIs represent the levels of determinants which are most likely to be observed in specimens collected in a healthy worker who has been exposed to chemicals to the same extent as a worker with inhalation exposure to the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
2,5-hexanedione in urine	5 mg/gm creatinine	End of shift	NS
n-Hexane in end-exhaled air			SQ

NS: Non-specific determinant; Metabolite observed following exposure to other materials.
SQ: Semi-quantitative determinant; Interpretation may be ambiguous - should be used as a screening test or confirmatory test.

Section 5 - Fire-Fighting Measures



Fire Diamond

Flash Point: -22 °C
Autoignition Temperature: 225 °C
LEL: 1.1% v/v
UEL: 7.5% v/v
Extinguishing Media: Dry chemical powder. Foam.
Carbon dioxide.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO). May emit clouds of acrid smoke.
Fire Incompatibility: Avoid reaction with oxidizing agents.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Pollutant - clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so.
Water spray or fog may be used to disperse/absorb vapor.
Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable products into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.

Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Avoid concurrent exposure to materials containing Methyl Ethyl Ketone MEK

Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.

Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.

Personal Protective Clothing/Equipment

Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Polyethylene gloves. Wear chemical protective gloves, eg. PVC.
Wear safety footwear.
Do NOT use this product to clean the skin.

Respiratory Protection:
Exposure Range >500 to <1100 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 1100 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Note: poor warning properties

Other: Overalls. Eyewash unit. Barrier cream. Skin cleansing cream.

Glove Selection Index:

PE/EVAL/PE	Best selection
PVA	Best selection
SARANEX-23 2-PLY	Best selection
VITON	Best selection
VITON/CHLOROBUTYL	Best selection
TEFLON	Satisfactory; may degrade after 4 hours continuous immersion
NITRILE	Satisfactory; may degrade after 4 hours continuous immersion
NEOPRENE	Poor to dangerous choice for other than short-term immersion
NEOPRENE/NATURAL	Poor to dangerous choice for other than short-term immersion
NITRILE+PVC	Poor to dangerous choice for other than short-term immersion
PVC	Poor to dangerous choice for other than short-term immersion
BUTYL	Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with typical paraffinic odor; floats on water. Mixes with most other organic solvents, chloroform, ether, alcohol. A very volatile liquid, it readily forms explosive vapor /air mixes.

Physical State: Liquid
Vapor Pressure (kPa): 13.33
Vapor Density (Air=1): 2.97
Formula Weight: 86.17
Specific Gravity (H_2O=1, at 4 °C): 0.6603 at 20 °C
Water Solubility: 0.002% by weight
pH: Not applicable

pH (1% Solution): Not applicable
Boiling Point Range: 68.89 °C (156 °F)
Freezing/Melting Point Range: -100 °C (-148 °F) to -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization/Conditions to Avoid: Presence of heat source and ignition source. Hazardous polymerization will not occur.

Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

TOXICITY
Oral (rat) LD_{50}: 28710 mg/kg
Inhalation (human) TC_{Lo}: 190 ppm/8W
Inhalation (rat) LD_{50}: 48000 ppm/4h

IRRITATION
Eye (rabbit): 10 mg - mild

See NIOSH, *RTECS* MN9275000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Photolysis, hydrolysis or bioconcentration are not expected to be an important environmental fate processes. Biodegradation may occur in soil and water; however, volatilization and adsorption are expected to be far more important fate processes. A K_{oc} range of 1250 to 4100 indicates a low to slight mobility class in soil. In aquatic systems it may partition from the water column to organic matter contained in sediments and suspended materials. A Henry's Law constant of 1.81 atm-cu m/mole at 25 °C suggests rapid volatilization from environmental waters. The volatilization half-lives from a model river and a model pond, the latter considers the effect of adsorption, have been estimated to be 2.7 hr and 6.8 days, respectively. It is expected to exist entirely in the vapor-phase in ambient air. Reactions with photochemically produced hydroxyl radicals in the atmosphere have been shown to be important (average estimated half-life of 2.9 days). Data also suggests that nighttime reactions with nitrate radicals may contribute to atmospheric transformation, especially in urban environments.
Ecotoxicity: No data found.
Henry's Law Constant: calculated at 1.81
BCF: estimated at 2.24 to 2.89
Biochemical Oxygen Demand (BOD): theoretical 0%, 7 days
Octanol/Water Partition Coefficient: log K_{ow} = 4.11
Soil Sorption Partition Coefficient: K_{oc} = estimated at 1250 to 4100

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: HEXANES
Hazard Class: 3.1
ID No.: 1208
Packing Group: II
Label: Flammable Liquid[3]

Additional Shipping Information: METHYLPENTANES

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per RCRA Section 3001 5000 lb (2268 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Nitric Acid
MSDS 7
NIT1080

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Nitric Acid **CAS Number:** 7697-37-2
Chemical Formula: HNO_3
Structural Chemical Formula: HNO_3
Synonyms: ACIDE NITRIQUE; ACIDO NITRICO; AQUA FORTIS; AZOTIC ACID; AZOTOWY KWAS; ENGRAVER'S ACID; ENGRAVERS ACID; HYDROGEN NITRATE; KYSELINA DUSICNE; NITAL; NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH >70% NITRIC ACID; NITRIC ACID OTHER THAN RED FUMING WITH NOT >70% NITRICACID; NITROUS FUMES; NITRYL HYDROXIDE; RED FUMING NITRIC ACID (RFNA); SALPETERSAURE; SALPETERZUUROPLOSSINGEN; WHITE FUMING NITRIC ACID (WFNA)
General Use: Manufacture of organic and inorganic nitrates and nitro compounds for fertilizers, dye intermediates and many organic chemicals.
Used for etching and cleaning metals.
Operators should be trained in procedures for safe use of this material.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
nitric acid	7697-37-2	>95

OSHA PEL
TWA: 2 ppm; 5 mg/m^3.

OSHA PEL Vacated 1989 Limits
TWA: 2 ppm; 5 mg/m^3; STEL: 4 ppm; 10 mg/m^3.

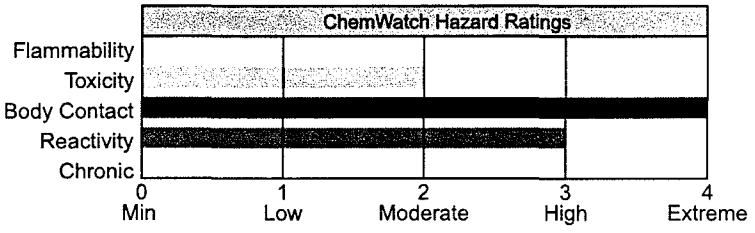
ACGIH TLV
TWA: 2 ppm; 5.2 mg/m^3; STEL: 4 ppm; 10 mg/m^3.

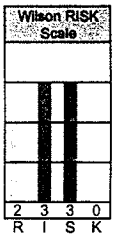
NIOSH REL
TWA: 2 ppm; 5 mg/m^3. STEL: 4 ppm; 10 mg/m^3.

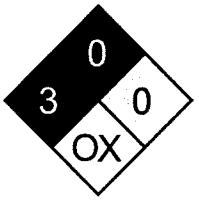
IDLH Level
25 ppm.

DFG (Germany) MAK
TWA: 2 ppm; 5 mg/m^3.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Danger!


Corrosive

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear to yellow fuming liquid; acrid, suffocating odor. Corrosive, causes severe burns to eyes/skin/respiratory tract. Also causes: heavy exposures: lung damage. Chronic: tooth erosion, bronchitis. Strong oxidizer capable of igniting combustibles.

Potential Health Effects

Primary Entry Routes: inhalation, ingestion, skin contact, eye contact
Target Organs: eyes, skin, respiratory system, teeth

Acute Effects

Inhalation: The vapor is extremely discomforting and corrosive to the upper respiratory tract and lungs and the material presents a hazard from a single acute exposure or from repeated exposures over long periods.
Inhalation hazard is increased at higher temperatures.
Reactions may occur following a single acute exposure or may only appear after repeated exposures.
Reactions may not occur on exposure but response may be delayed with symptoms only appearing many hours later.
The material may produce respiratory tract irritation which produces an inflammatory response involving the recruitment and activation of many cell types, mainly derived from the vascular system. Unlike most organs the lung can respond to a chemical insult or agent by first trying to remove or neutralize the irritant and then repairing the damage. The repair process, which initially developed to protect mammalian lungs from foreign matter and antigens, may however, cause further damage the lungs when activated by hazardous chemicals. The result is often the impairment of gas exchange, the primary function of the lungs.
Inhalation of nitric acid mist or fumes at 2 to 25 ppm over an 8 hour period may cause pulmonary irritation and symptoms of lung damage.
Only several minutes of exposure to concentrated atmosphere i.e. 200 ppm may cause severe pulmonary damage and even fatality. Death may be delayed for several days.
Exposure to nitric acid fumes (with concurrent inhalation of nitrogen dioxide and nitric oxide) may elicit prompt irritation of the upper respiratory tract leading to coughing, gagging, chest pain, dyspnea, cyanosis if concentrations are sufficiently high and duration of exposure sufficiently long, pulmonary edema.

Eye: The liquid is extremely corrosive to the eyes and contact may cause rapid tissue destruction and is capable of causing severe damage with loss of sight.
The vapor is extremely discomforting to the eyes 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.
The material may produce moderate eye irritation leading to inflammation.
Repeated or prolonged exposure to irritants may produce conjunctivitis.
Eye contact with concentrated acid may give no pain, whilst diluted solution causes intense pain and both can cause permanent eye damage or blindness. Burns may result in shrinkage of the eyeball, symblepharon (adhesions between tarsal and bulbar conjunctivae), permanent corneal opacification, and visual impairment leading to blindness.

Skin: The liquid is extremely corrosive to the skin and contact may cause tissue destruction with severe burns.
Bare unprotected skin should not be exposed to this material.
The vapor is highly discomforting to the skin.
The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.
Skin contact causes yellow discoloration of the skin, blisters and scars that may not heal. The skin may be stained bright-yellow or yellowish brown due to the formation of xanthoproteic acid. Dilute solutions may harden the epithelium without producing overt corrosion.

Ingestion: Considered an unlikely route of entry in commercial/industrial environments.
The material is extremely corrosive if swallowed and is capable of causing burns to mouth, throat, esophagus, with extreme discomfort, pain and may be fatal.
Even a small amount causes severe corrosion of the stomach, burning pain, vomiting and shock, possibly causing non-healing scarring of the gastrointestinal tract and stomach. Death may be delayed 12 hours to 14 days or to several months. Such late fatalities are attributed to a chemical lobular pneumonitis secondary to aspiration. Survivors show stricture of the gastric mucosa and subsequent pernicious anemia.

Carcinogenicity: NTP - Not listed; IARC - Not listed; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Not listed; MAK - Not listed.

Chronic Effects: Prolonged or repeated overexposure to low concentrations of vapor may cause chronic bronchitis, corrosion of teeth, even chemical pneumonitis.

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.
Lay patient down. Keep warm and rested.
If available, administer medical oxygen by trained personnel.
If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.
Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.
Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.
Immediately transport to hospital or doctor. DO NOT delay.

Skin Contact: Immediately flush body and clothes with large amounts of water, using safety shower if available.
Quickly remove all contaminated clothing, including footwear.

Wash affected areas with water (and soap if available) for at least 15 minutes. Transport to hospital or doctor. DO NOT delay.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

Immediately transport to hospital or doctor. DO NOT delay.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to strong acids:

1.Airway problems may arise from laryngeal edema and inhalation exposure.

Treat with 100% oxygen initially.

2.Respiratory distress may require cricothyroidotomy if endotracheal intubation is contraindicated by excessive swelling.

3. Intravenous lines should be established immediately in all cases where there is evidence of circulatory compromise.

4.Strong acids produce a coagulation necrosis characterized by formation of a coagulum (eschar) as a result of the desiccating action of the acid on proteins in specific tissues.

INGESTION:

1.Immediate dilution (milk or water) within 30 minutes post-ingestion is recommended.

2.Do not attempt to neutralize the acid since exothermic reaction may extend the corrosive injury.

3.Be careful to avoid further vomiting since re-exposure of the mucosa to the acid is harmful. Limit fluids to one or two glasses in an adult.

4.Charcoal has no place in acid management.

5.Some authors suggest the use of lavage within 1 hour of ingestion.

SKIN:

1.Skin lesions require copious saline irrigation. Treat chemical burns as thermal burns with non-adherent gauze and wrapping.

2.Deep second-degree burns may benefit from topical silver sulfadiazine.

EYE:

1.Eye injuries require retraction of the eyelids to ensure thorough irrigation of the conjunctival cul-de-sacs. Irrigation should last at least 20-30 minutes. Do not use neutralizing agents or any other additives. Several liters of saline are required.

2.Cycloplegic drops (1% cyclopentolate for short-term use or 5% homatropine for longer term use), antibiotic drops, vasoconstrictive agents, or artificial tears may be indicated dependent on the severity of the injury.

3.Steroid eye drops should only be administered with the approval of a consulting ophthalmologist.

Section 5 - Fire-Fighting Measures

Flash Point: Nonflammable

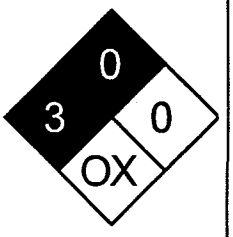
Autoignition Temperature: Not applicable

LEL: Not applicable

UEL: Not applicable

Extinguishing Media: Water spray or fog; foam, dry chemical powder, or BCF (where regulations permit).

Carbon dioxide.



Fire Diamond

General Fire Hazards/Hazardous Combustion Products: Will not burn but increases intensity of fire.

Heating may cause expansion or decomposition leading to violent rupture of containers. Heat affected containers remain hazardous.

Contact with combustibles such as wood, paper, oil or finely divided metal may cause ignition, combustion or violent decomposition.

May emit irritating, poisonous or corrosive fumes.

Decomposes on heating and produces toxic fumes of nitrogen oxides (NO_x) and nitric acid.

Fire Incompatibility: Oxidizing agents as a class are not necessarily combustible themselves, but can increase the risk and intensity of fire in many other substances.

Reacts vigorously with water and alkali.

Avoid reaction with organic materials/compounds, powdered metals, reducing agents and hydrogen sulfide (H_2S) as ignition may result.

Reacts with metals producing flammable/explosive hydrogen gas.

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.

May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.

Fight fire from a safe distance, with adequate cover.

Extinguishers should be used only by trained personnel.

Use water delivered as a fine spray to control fire and cool adjacent area.

Avoid spraying water onto liquid pools.

Do not approach containers suspected to be hot.

Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.
If fire gets out of control withdraw personnel and warn against entry.
Equipment should be thoroughly decontaminated after use.

Section 6 - Accidental Release Measures

Small Spills: Dangerous levels of nitrogen oxides may form during spills of nitric acid.
Wear fully protective PVC clothing and breathing apparatus.
Clean up all spills immediately. No smoking, bare lights, ignition sources.
Avoid all contact with any organic matter including fuel, solvents, sawdust, paper or cloth and other incompatible materials, as ignition may result.
Avoid breathing dust or vapors and all contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb spill with dry sand, earth, inert material or vermiculite. DO NOT use sawdust as fire may result.
Scoop up solid residues and seal in labeled drums for disposal.
Neutralize/decontaminate area.
Use soda ash or slaked lime to neutralize.
Large Spills: DO NOT touch the spill material. Restrict access to area.
Clear area of personnel and move upwind. Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear full body protective clothing with breathing apparatus. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, flames or ignition sources. Increase ventilation.
Contain spill with sand, earth or other clean, inert materials.
NEVER use organic absorbents such as sawdust, paper, cloth; as fire may result. Avoid any contamination by organic matter.
Use spark-free and explosion-proof equipment.
Collect any recoverable product into labeled containers for possible recycling. DO NOT mix fresh with recovered material.
Collect residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains. Decontaminate equipment and launder all protective clothing before storage and reuse.
If contamination of drains or waterways occurs advise emergency services.
DO NOT USE WATER OR NEUTRALIZING AGENTS INDISCRIMINATELY ON LARGE SPILLS.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid generating and breathing mist. Do not allow clothing wet with material to stay in contact with skin.
Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area.
WARNING: To avoid violent reaction, ALWAYS add material to water and NEVER water to material.
Avoid smoking, bare lights or ignition sources.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling. Work clothes should be laundered separately.
Launder contaminated clothing before reuse.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions are maintained.
Recommended Storage Methods: Stainless steel drum. Check that containers are clearly labeled.
Packaging as recommended by manufacturer.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area.
Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.

Personal Protective Clothing/Equipment

Eyes: Chemical goggles. Full face shield.
DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Bare unprotected skin should not be exposed to this material. Impervious, gauntlet length gloves i.e., butyl rubber gloves or Neoprene rubber gloves or wear chemical protective gloves, e.g. PVC.
Wear safety footwear or safety gumboots, e.g. Rubber.

Respiratory Protection:
Exposure Range >2 to <25 ppm: Supplied Air, Constant Flow/Pressure Demand, Half Mask
Exposure Range 25 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face

Other: Operators should be trained in procedures for safe use of this material.
Acid-resistant overalls or Rubber apron or PVC apron.
Ensure there is ready access to an emergency shower.
Ensure that there is ready access to eye wash unit.
Ensure that there is ready access to breathing apparatus.

Glove Selection Index:

BUTYL	A
HYPALON	A
NEOPRENE	A
NEOPRENE/NATURAL	A
PE/EVAL/PE	A
SARANEX-23	A
NATURAL RUBBER	B
NATURAL+NEOPRENE	B
PVC	C
NITRILE+PVC	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear, colorless to slightly yellow liquid. Sharp strong odor.
CAUTION: exothermic dilution hazard.
HIGHLY CORROSIVE. Corrosive to most metals. Powerful oxidizing agent.
Darkens to brownish color on aging and exposure to light.

Physical State: Liquid
Vapor Pressure (kPa): 8.26
Vapor Density (Air=1): 1.5
Formula Weight: 63.02
Specific Gravity (H_2O=1, at 4 °C): 1.3-1.42
Water Solubility: Soluble in all proportions
pH: < 1
pH (1% Solution): 1
Boiling Point Range: 83 °C (181 °F) at 760 mm Hg
Freezing/Melting Point Range: -42 °C (-43.6 °F)
Volatile Component (% Vol): 100 (nominal)
Decomposition Temperature (°C): Not applicable

Section 10 - Stability and Reactivity

Stability/Polymerization: Presence of heat source and direct sunlight. Storage in unsealed containers. Hazardous polymerization will not occur.

Storage Incompatibilities: Segregate from reducing agents, finely divided combustible materials, combustible materials, sawdust, metals and powdered metals.
Avoid contamination of water, foodstuffs, feed or seed.
Segregate from alkalies, oxidizing agents and chemicals readily decomposed by acids, i.e. cyanides, sulfides, carbonates.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (human) LD_{Lo}: 430 mg/kg
Inhalation (rat) LC_{50}: 2500 ppm/1 hr
Unreported (man) LD_{Lo}: 110 mg/kg

IRRITATION
Nil reported

See NIOSH, *RTECS* QU 5775000, for additional data.

Section 12 - Ecological Information

Environmental Fate: No data found.

Ecotoxicity: LC_{50} Starfish 100-300 mg/l/48 hr /Aerated water conditions; LC_{50} Shore crab 180 mg/l/48 hr /Static, aerated water conditions; LC_{50} Cockle 330-1000 mg/l/48 hr /Aerated water conditions
BCF: no food chain concentration potential
Biochemical Oxygen Demand (BOD): none

Section 13 - Disposal Considerations

Disposal: Recycle wherever possible. Special hazards may exist - specialist advice may be required.
Consult manufacturer for recycling options.
Follow applicable federal, state, and local regulations.
Treat and neutralize at an approved treatment plant.
Decontaminate empty containers. Observe all label safeguards until containers are cleaned and destroyed.
Puncture containers to prevent reuse and bury at an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: NITRIC ACID
Hazard Class: 8
ID No.: 2031
Packing Group: I
Label: Corrosive[8],Oxid.Agent

Additional Shipping Information:

Section 15 - Regulatory Information

EPA Regulations:
RCRA 40 CFR: Not listed
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4) 1000 lb (453.5 kg)
SARA 40 CFR 372.65: Listed 1000 lb
SARA EHS 40 CFR 355: Listed 1,000 lb
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Toluene
MSDS 317
TOL2320

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Toluene **CAS Number:** 108-88-3
Chemical Formula: C_7H_8
Structural Chemical Formula: $C_6H_5CH_3$
Synonyms: ANTISAL 1A; BENZENE,METHYL-; CP 25; METHACIDE; METHANE,PHENYL-; METHYL BENZENE; METHYL BENZOL; METHYLBENZENE; METHYLBENZOL; PHENYL METHANE; PHENYLMETHANE; TOLUEEN; TOLUEN; TOLUENE; TOLUENO; TOLUOL; TOLUOLO; TOLU-SOL
General Use: Used as a solvent for paint, resins, lacquers inks & adhesives. Component of solvent blends and thinners; in gasoline and aviation fuel. Used in the manufacture of chemicals, dyes, explosives, benzoic acid.
Some grades of toluene may contain traces of xylene and benzene.
Odor threshold: 2 ppm approx. Odor is not a reliable warning property due to olfactory fatigue.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
toluene	108-88-3	> 99.5

OSHA PEL
TWA: 200 ppm; STEL: 300 ppm; from Table Z-2. Other Values: 500 mg/m^3; 10 min peak 8hr ppm.

OSHA PEL Vacated 1989 Limits
TWA: 100 ppm; 375 mg/m^3; STEL: 150 ppm; 560 mg/m^3.

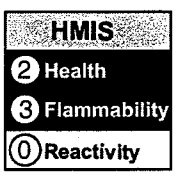
ACGIH TLV
TWA: 50 ppm; 188 mg/m^3.

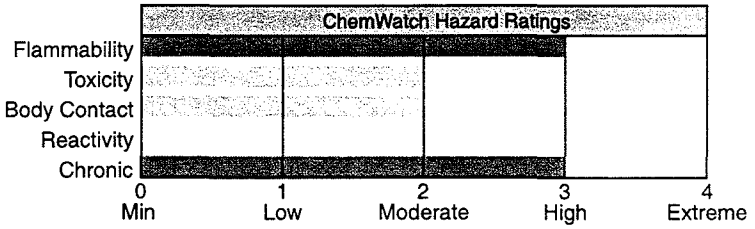
NIOSH REL
TWA: 100 ppm; 375 mg/m^3. STEL: 150 ppm; 560 mg/m^3.

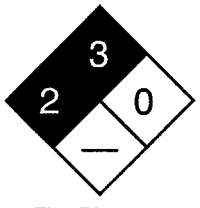
IDLH Level
500 ppm.

DFG (Germany) MAK
TWA: 50 ppm; 190 mg/m^3.

Section 3 - Hazards Identification







Fire Diamond

ANSI Signal Word
Danger!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Colorless liquid; sickly, sweet odor. Irritating to the eyes/skin/respiratory tract. Also causes: weakness, headache, dizziness, confusion, and insomnia. Chronic: liver and kidney damage. May cause birth defects. Flammable.

Potential Health Effects

Primary Entry Routes: Inhalation, skin contact/absorbtion.
Target Organs: Skin, liver, kidneys, central nervous system.
Acute Effects
Inhalation: The vapor is highly discomforting to the upper respiratory tract.
Inhalation hazard is increased at higher temperatures.

Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Central nervous system (CNS) depression may include nonspecific discomfort, symptoms of giddiness, headache, dizziness, nausea, anesthetic effects, slowed reaction time, slurred speech and may progress to unconsciousness. Serious poisonings may result in respiratory depression and may be fatal.

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. The vapor is discomforting to the eyes if exposure is prolonged.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Skin: The liquid may produce skin discomfort following prolonged contact.

Defatting and/or drying of the skin may lead to dermatitis and it is absorbed by skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: 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.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Class A4, Not classifiable as a human carcinogen; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Chronic toluene habituation occurs following intentional abuse (glue-sniffing) or from occupational exposure. Ataxia, incoordination and tremors of the hands and feet (as a consequence of diffuse cerebral atrophy), headache, abnormal speech, transient memory loss, convulsions, coma, drowsiness, reduced color perception, frank blindness, nystagmus (rapid, involuntary eye-movements), decreased hearing leading to deafness and mild dementia have all been associated with chronic abuse.

Peripheral nerve damage, encephalopathy, giant axonopathy, electrolyte disturbances in the cerebrospinal fluid and abnormal computer tomographic (CT) scans are common amongst toluene addicts. Although toluene abuse has been linked with kidney disease, this does not commonly appear in cases of occupational toluene exposures. Cardiac and hematological toxicity are however associated with chronic toluene exposure. Cardiac arrhythmia, multifocal and premature ventricular contractions and supraventricular tachycardia are present in 20% of patients who abused toluene-containing paints.

Previous suggestions that chronic toluene inhalation produced human peripheral neuropathy have largely been discounted. However central nervous system (CNS) depression is well documented where blood toluene levels exceed 2.2 mg%. Toluene abusers can achieve transient circulating concentrations of 6.5 mg%. Amongst workers exposed for a median time of 29 years to toluene no subacute effects on neurasthenic complaints and pyschometric test results could be established.

The prenatal toxicity of very high toluene concentrations has been documented for several animal species and man. Malformations indicative of specific teratogenicity have not generally been found. The toxicity described in the literature takes the form of embryo death or delayed fetal growth and delayed skeletal system development. Permanent damage of children has been seen only when mothers had suffered from chronic intoxication as a result of "sniffing".

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water. Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: Following acute or short-term repeated exposures to toluene:

1. Toluene is absorbed across to alveolar barrier, the blood/air mixture being 11.2/15.6 (at 37 °C) The order of toluene, in expired breath, is of the order of 18 ppm following sustained exposure to 100 ppm.
The tissue/blood proportion is 1/3 except in adipose where the proportion is 8/10.
2.Metabolism by microsomal mono-oxygenation, results in the production of hippuric acid. This may be detected in the urine in amounts between 0.5 and 2.5 g/24hr which represents, on average 0.8 gm/gm of creatinine.
The biological half life of hippuric acid is in the order of 1-2 hours.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
8.Lavage is indicated in patients who require decontamination; ensure use of cuffed endotracheal tube in adult patients.

BIOLOGICAL EXPOSURE INDEX - BEI

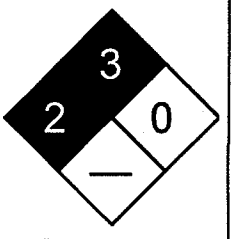
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Hippuric acid in urine	2.5 gm/gm creatinine	End of shift Last 4 hrs of shift	B,NS
Toluene in venous blood	1 mg/L	End of shift	SQ
Toluene in end-exhaled air		End of shift	SQ

NS: Non-specific determinant; also observed after exposure to other material
SQ: Semi-quantitative determinant - Interpretation may be ambiguous; should be used as a screening test or confirmatory test.
B: Background levels occur in specimens collected from subjects NOT exposed.

Section 5 - Fire-Fighting Measures

Flash Point: 4 °C Closed Cup
Autoignition Temperature: 480 °C
LEL: 1.2% v/v
UEL: 7.1% v/v
Extinguishing Media: Foam, dry chemical powder, BCF (where regulations permit), carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are highly flammable.
Severe fire hazard when exposed to heat, flame and/or oxidizers.
Vapor forms an explosive mixture with air.
Severe explosion hazard, in the form of vapor, when exposed to flame or spark. Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion/decomposition with violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO) and carbon dioxide (CO_2).
Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Nitric acid with toluene, produces nitrated compounds which are explosive.



Fire Diamond

Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
Fight fire from a safe distance, with adequate cover.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control the fire and cool adjacent area. Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protective location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways. Consider evacuation.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.
Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of exposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights, heat or ignition sources.
When handling, DO NOT eat, drink or smoke.
Vapor may ignite on pumping or pouring due to static electricity.
DO NOT use plastic buckets. Ground and secure metal containers when dispensing or pouring product. Use spark-free tools when handling.
Avoid contact with incompatible materials.
Keep containers securely sealed. Avoid physical damage to containers.
Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Use good occupational work practices. Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; Metal drum; Metal safety cans. Packing as supplied by manufacturer.
Plastic containers may only be used if approved for flammable liquid.
Check that containers are clearly labeled and free from leaks.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area; local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in special circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator. Correct fit is essential to ensure adequate protection.
Provide adequate ventilation in warehouses and enclosed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; chemical goggles. Full face shield.

DO NOT wear contact lenses. Contact lenses pose a special hazard; soft contact lenses may absorb irritants and all lenses concentrate them.

Hands/Feet: Wear chemical protective gloves, eg. PVC. Wear safety footwear.

Respiratory Protection:

Exposure Range >200 to <500 ppm: Air Purifying, Negative Pressure, Half Mask
Exposure Range 500 to unlimited ppm: Self-contained Breathing Apparatus, Pressure Demand, Full Face
Cartridge Color: black

Other: Overalls. Barrier cream. Eyewash unit.

Glove Selection Index:

PE/EVAL/PE	A
VITON/CHLOROBUTYL	A
VITON	A
PVA	A
TEFLON	B
SARANEX-23 2-PLY	C
CPE	C
VITON/NEOPRENE	C
SARANEX-23	C
NEOPRENE/NATURAL	C
NITRILE+PVC	C
NITRILE	C
BUTYL	C
PVC	C
NEOPRENE	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear highly flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 2.93 at 20 °C
Vapor Density (Air=1): 3.2
Formula Weight: 92.14
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 20 °C
Water Solubility: < 1 mg/mL at 18 °C
Evaporation Rate: 2.4 (BuAc=1)

pH: Not applicable
pH (1% Solution): Not applicable.
Boiling Point Range: 111 °C (232 °F) at 760 mm Hg
Freezing/Melting Point Range: -95 °C (-139 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Segregate from strong oxidizers.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 636 mg/kg
Inhalation (human) TC_{Lo}: 100 ppm
Inhalation (man) TC_{Lo}: 200 ppm
Inhalation (rat) LC_{50}: > 26700 ppm/1h
Dermal (rabbit) LD_{50}: 12124 mg/kg
Reproductive effector in rats

IRRITATION
Skin (rabbit): 20 mg/24h-moderate
Skin (rabbit): 500 mg - moderate
Eye (rabbit): 0.87 mg - mild
Eye (rabbit): 2 mg/24h - SEVERE
Eye (rabbit): 100 mg/30sec - mild

See NIOSH, *RTECS* XS 5250000, for additional data.

Section 12 - Ecological Information

Environmental Fate: If released to soil, it will be lost by evaporation from near-surface soil and by leaching to the groundwater. Biodegradation occurs both in soil and groundwater, but it is apt to be slow especially at high concentrations, which may be toxic to microorganisms. The presence of acclimated microbial populations may allow rapid biodegradation. It will not significantly hydrolyze in soil or water under normal environmental conditions. If released into water, its concentration will decrease due to evaporation and biodegradation. This removal can be rapid or take several weeks, depending on temperature, mixing conditions, and acclimation of microorganisms. It will not significantly adsorb to sediment or bioconcentrate in aquatic organisms. If released to the atmosphere, it will degrade by reaction with photochemically produced hydroxyl radicals (half-life 3 hr to slightly over 1 day) or be washed out in rain. It will not be subject to direct photolysis.

Ecotoxicity: LC_{50} Aedes aegypti-4th instar (mosquito larvae) 22 mg/l /Conditions of bioassay not specified; LC_{50} Cyprinodon variegatus (sheepshead minnow) 277-485 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Calandra granaria (grain weevil) 210 mg/l /in air; LC_{50} Cancer magister (crab larvae stage I) 28 ppm/96 hr /Conditions of bioassay not specified; LC_{50} Crangon franciscorum (shrimp) 4.3 ppm 96 hr /Conditions of bioassay not specified; LC_{50} Artemia salina (brine shrimp) 33 mg/l 24 hr /Conditions of bioassay not specified; LC_{50} Morone saxatilis (striped bass) 7.3 mg/l 96 hr /Conditions of bioassay not specified; LC_{50} Pimephales promelas (fathead minnows) 55-72 mg/l (embryos), 25-36 mg/l (1-day posthatch protolarvae), and 26-31 mg/l (30-day-old minnows)/ 96 hour /Conditions of bioassay not specified

Henry's Law Constant: 0.0067

BCF: eels 13.2

Biochemical Oxygen Demand (BOD): 0%, 5 days

Octanol/Water Partition Coefficient: log K_{ow} = 2.69

Soil Sorption Partition Coefficient: K_{oc} = silty loam 37

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: TOLUENE

Additional Shipping Information: TOLUOL

Hazard Class: 3.1

ID No.: 1294

Packing Group: II

Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U220 Toxic Waste

CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per RCRA Section 3001; per CWA Section 307(a) 1000 lb (453.5 kg)

SARA 40 CFR 372.65: Listed

SARA EHS 40 CFR 355: Not listed

TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

Material Safety Data Sheet Collection
Genium Publishing Corp.
1171 RiverFront Center
Amsterdam, NY 12010
(518) 842-4111

Issue Date: 2000-07

Xylene
MSDS 318
XYL2260

Section 1 - Chemical Product and Company Identification 54.1

Material Name: Xylene **CAS Number:** 1330-20-7
Chemical Formula: C_8H_{10}
Structural Chemical Formula: $C_6H_4(CH_3)_2$
Synonyms: BENZENE,DIMETHYL-; COMPONENT 1 (83%): XYLENES; COMPONENT 2 (17%): ETHYL BENZENE; DIMETHYLBENZENE; DIMETHYLBENZENES; EPA PESTICIDE CHEMICAL CODE 086802; KSYLEN; METHYL TOLUENE; METHYLTOLUENE; VIOLET 3; XILOLI; XYLENE; XYLENEN; XYLOL; XYLOLE
General Use: A strong solvent for general use in the manufacture of paints, varnishes, lacquers, thinners, inks, rubber, pesticides, herbicides and paint strippers.

Section 2 - Composition / Information on Ingredients

Name	CAS	%
xylene	1330-20-7	> 95

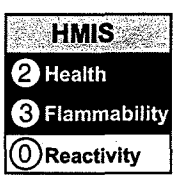
OSHA PEL
TWA: 100 ppm; 435 mg/m^3.

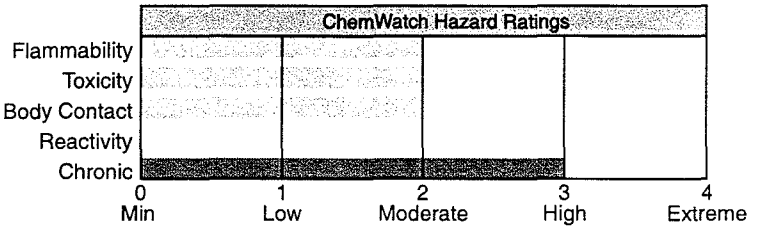
NIOSH REL
TWA: 100 ppm; 435 mg/m^3.
STEL: 150 ppm; 655 mg/m^3.

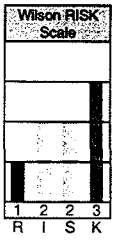
DFG (Germany) MAK
TWA: 100 ppm; 440 mg/m^3.

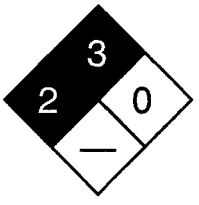
ACGIH TLV
TWA: 100 ppm; 434 mg/m^3;
STEL: 150 ppm; 651 mg/m^3.

Section 3 - Hazards Identification









Fire Diamond

ANSI Signal Word
Warning!


Flammable

☆☆☆☆☆ Emergency Overview ☆☆☆☆☆

Clear, sweet smelling liquid. Irritating to the eyes/skin/respiratory tract. Also causes: dizziness, nausea, and drowsiness. Chronic: dermatitis, kidney/liver/peripheral nerve damage. May cause birth defects based on animal data. Flammable.

Potential Health Effects

Primary Entry Routes: inhalation, skin absorption (slight), eye contact, ingestion
Target Organs: central nervous system (CNS), eyes, gastrointestinal (GI) tract, liver, kidneys, skin
Acute Effects
Inhalation: Xylene is a central nervous system depressant. The vapor is discomforting to the upper respiratory tract and may be harmful if inhaled.
Inhalation hazard is increased at higher temperatures.
Toxic effects are increased by consumption of alcohol.
Acute effects from inhalation of high concentrations of vapor are pulmonary irritation, including coughing, with nausea; central nervous system depression - characterized by headache and dizziness, increased reaction time, fatigue and loss of coordination.

If exposure to highly concentrated solvent atmosphere is prolonged this may lead to narcosis, unconsciousness, even coma and possible death.

Headache, fatigue, lassitude, irritability and gastrointestinal disturbances (e.g., nausea, anorexia and flatulence) are the most common symptoms of xylene overexposure. Injury to the heart, liver, kidneys and nervous system has also been noted among workers. Transient memory loss, renal impairment, temporary confusion and some evidence of disturbance of liver function was reported in three workers overcome by gross exposure to xylene (10000 ppm). One worker died and autopsy revealed pulmonary congestion, edema, and focal alveolar hemorrhage.

Volunteers inhaling xylene at 100 ppm for 5 to 6 hours showed changes in manual coordination, reaction time and slight ataxia. Tolerance developed during the workweek but was lost over the weekend. Physical exercise may antagonize this effect. Xylene body burden in humans exposed to 100 or 200 ppm xylene in air depends on the amount of body fat with 4% to 8% of total absorbed xylene accumulating in human adipose tissues.

Eye: The liquid is highly discomforting to the eyes and is capable of causing a mild, temporary redness of the conjunctiva (similar to wind-burn), temporary impairment of vision and/or other transient eye damage/ulceration.

The vapor is highly discomforting to the eyes.

The material may produce severe irritation to the eye causing pronounced inflammation. Repeated or prolonged exposure to irritants may produce conjunctivitis.

Corneal changes have been reported in furniture polishers exposed to xylene.

Skin: The liquid is highly discomforting to the skin and may cause drying of the skin, which may lead to dermatitis and it is absorbed by the skin.

Toxic effects may result from skin absorption.

Open cuts, abraded or irritated skin should not be exposed to this material.

The material may accentuate any pre-existing skin condition.

The material may cause skin irritation after prolonged or repeated exposure and may produce a contact dermatitis (nonallergic). This form of dermatitis is often characterized by skin redness (erythema) and swelling (edema) which may progress to vesiculation, scaling and thickening of the epidermis. Histologically there may be intercellular edema of the spongy layer (spongiosis) and intracellular edema of the epidermis.

Ingestion: 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.

Carcinogenicity: NTP - Not listed; IARC - Group 3, Not classifiable as to carcinogenicity to humans; OSHA - Not listed; NIOSH - Not listed; ACGIH - Not listed; EPA - Class D, Not classifiable as to human carcinogenicity; MAK - Not listed.

Chronic Effects: Chronic solvent inhalation exposures may result in nervous system impairment and liver and blood changes.

Prolonged or continuous skin contact with the liquid may cause defatting with drying, cracking, irritation and dermatitis following.

Small excess risks of spontaneous abortion and congenital malformation was reported amongst women exposed to xylene in the first trimester of pregnancy. In all cases however the women had also been exposed to other substances.

Evaluation of workers chronically exposed to xylene has demonstrated a lack of genotoxicity. Exposure to xylene has been associated with increased risks of hemopoietic malignancies but, again simultaneous exposure to other substances (including benzene) complicate the picture. A long-term gavage study of mixed xylenes (containing 17% ethyl benzene) found no evidence of carcinogenic activity in rats and mice of either sex.

Exposure to the material for prolonged periods may cause physical defects in the developing embryo (teratogenesis).

Section 4 - First Aid Measures

Inhalation: Remove to fresh air.

Lay patient down. Keep warm and rested.

If available, administer medical oxygen by trained personnel.

If breathing is shallow or has stopped, ensure clear airway and apply resuscitation. Transport to hospital or doctor, without delay.

Eye Contact: Immediately hold the eyes open and flush continuously for at least 15 minutes with fresh running water.

Ensure irrigation under eyelids by occasionally lifting the upper and lower lids.

Transport to hospital or doctor without delay. Removal of contact lenses after an eye injury should only be undertaken by skilled personnel.

Skin Contact: Immediately remove all contaminated clothing, including footwear (after rinsing with water).

Wash affected areas thoroughly with water (and soap if available).

Seek medical attention in event of irritation.

Ingestion: Contact a Poison Control Center.

Do NOT induce vomiting. Give a glass of water.

After first aid, get appropriate in-plant, paramedic, or community medical support.

Note to Physicians: For acute or short-term repeated exposures to xylene:

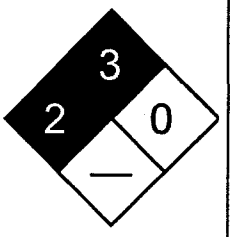
1.Gastrointestinal absorption is significant with ingestions.

For ingestions exceeding 1-2 mL (xylene)/kg, intubation and lavage with cuffed endotracheal tube is recommended. The use of charcoal and cathartics is equivocal.
2.Pulmonary absorption is rapid with about 60-65% retained at rest.
3.Primary threat to life from ingestion and/or inhalation is respiratory failure.
4.Patients should be quickly evaluated for signs of respiratory distress (e.g. cyanosis, tachypnea, intercostal retraction, obtundation) and given oxygen. Patients with inadequate tidal volumes or poor arterial blood gases (pO_2 <50 mm Hg or pCO_2 >50 mm Hg) should be intubated.
5.Arrhythmias complicate some hydrocarbon ingestion and/or inhalation and electrocardiographic evidence of myocardial injury has been reported; intravenous lines and cardiac monitors should be established in obviously symptomatic patients. The lungs excrete inhaled solvents, so that hyperventilation improves clearance.
6.A chest x-ray should be taken immediately after stabilization of breathing and circulation to document aspiration and detect the presence of pneumothorax.
7.Epinephrine (adrenalin) is not recommended for treatment of bronchospasm because of potential myocardial sensitization to catecholamines.
Inhaled cardioselective bronchodilators (e.g. Alupent, Salbutamol) are the preferred agents, with aminophylline a second choice.
BIOLOGICAL EXPOSURE INDEX - BEI
These represent the determinants observed in specimens collected from a healthy worker exposed at the Exposure Standard (ES or TLV):

Determinant	Index	Sampling Time	Comments
Methylhippuric acids in urine	1.5 gm/gm creatinine	End of shift	
	2 mg/min	Last 4 hrs of shift.	

Section 5 - Fire-Fighting Measures

Flash Point: 25.6 °C
Autoignition Temperature: 241 °C
LEL: 1.0% v/v
UEL: 7.0% v/v
Extinguishing Media: Alcohol stable foam; dry chemical powder; carbon dioxide.
Water spray or fog - Large fires only.
General Fire Hazards/Hazardous Combustion Products: Liquid and vapor are flammable.
Moderate fire hazard when exposed to heat or flame.
Vapor forms an explosive mixture with air.
Moderate explosion hazard when exposed to heat or flame.
Vapor may travel a considerable distance to source of ignition.
Heating may cause expansion or decomposition leading to violent rupture of containers.
On combustion, may emit toxic fumes of carbon monoxide (CO).
Other combustion products include carbon dioxide (CO_2).



Fire Diamond

Fire Incompatibility: Avoid contamination with strong oxidizing agents as ignition may result.
Fire-Fighting Instructions: Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
If safe, switch off electrical equipment until vapor fire hazard removed.
Use water delivered as a fine spray to control fire and cool adjacent area.
Avoid spraying water onto liquid pools.
Do not approach containers suspected to be hot.
Cool fire-exposed containers with water spray from a protected location.
If safe to do so, remove containers from path of fire.

Section 6 - Accidental Release Measures

Small Spills: Remove all ignition sources. Clean up all spills immediately.
Avoid breathing vapors and contact with skin and eyes.
Control personal contact by using protective equipment.
Contain and absorb small quantities with vermiculite or other absorbent material. Wipe up. Collect residues in a flammable waste container.
Large Spills: Clear area of personnel and move upwind.
Contact fire department and tell them location and nature of hazard.
May be violently or explosively reactive. Wear breathing apparatus plus protective gloves. Prevent, by any means available, spillage from entering drains or waterways.
No smoking, bare lights or ignition sources. Increase ventilation.
Stop leak if safe to do so. Water spray or fog may be used to disperse/absorb vapor. Contain spill with sand, earth or vermiculite.

Use only spark-free shovels and explosion proof equipment.
Collect recoverable product into labeled containers for recycling.
Absorb remaining product with sand, earth or vermiculite.
Collect solid residues and seal in labeled drums for disposal.
Wash area and prevent runoff into drains.
If contamination of drains or waterways occurs, advise emergency services.
Regulatory Requirements: Follow applicable OSHA regulations (29 CFR 1910.120).

Section 7 - Handling and Storage

Handling Precautions: Avoid all personal contact, including inhalation.
Wear protective clothing when risk of overexposure occurs.
Use in a well-ventilated area. Prevent concentration in hollows and sumps.
DO NOT enter confined spaces until atmosphere has been checked.
Avoid smoking, bare lights or ignition sources.
Avoid generation of static electricity. DO NOT use plastic buckets.
Ground all lines and equipment. Use spark-free tools when handling.
Avoid contact with incompatible materials.
When handling, DO NOT eat, drink or smoke.
Keep containers securely sealed when not in use. Avoid physical damage to containers. Always wash hands with soap and water after handling.
Work clothes should be laundered separately.
Observe manufacturer's storing and handling recommendations. Atmosphere should be regularly checked against established exposure standards to ensure safe working conditions.
Recommended Storage Methods: Metal can; metal drum. Packing as recommended by manufacturer.
Check all containers are clearly labeled and free from leaks.
Plastic containers may only be used if approved for flammable liquids.
Regulatory Requirements: Follow applicable OSHA regulations.

Section 8 - Exposure Controls / Personal Protection

Engineering Controls: Use in a well-ventilated area. Local exhaust ventilation may be required for safe working, i.e., to keep exposures below required standards; otherwise, PPE is required.
CARE: Use of a quantity of this material in confined space or poorly ventilated area, where rapid build-up of concentrated atmosphere may occur, could require increased ventilation and/or protective gear.
General exhaust is adequate under normal operating conditions.
Local exhaust ventilation may be required in specific circumstances.
If risk of overexposure exists, wear NIOSH-approved respirator.
Correct fit is essential to obtain adequate protection.
Provide adequate ventilation in warehouse or closed storage areas.
In confined spaces where there is inadequate ventilation, wear full-face air supplied breathing apparatus.
Personal Protective Clothing/Equipment
Eyes: Safety glasses with side shields; or as required, chemical goggles.
Contact lenses pose a special hazard; soft lenses may absorb irritants and all lenses concentrate them.
Hands/Feet: Barrier cream with polyethylene gloves; Butyl rubber gloves or Neoprene gloves or PVC gloves.
Safety footwear.
Do NOT use this product to clean the skin.
Other: Overalls. Impervious protective clothing.
Eyewash unit.
Ensure there is ready access to an emergency shower.
Glove Selection Index:

PE/EVAL/PE	A
PVA	A
VITON	A
TEFLON	A
PVDC/PE/PVDC	C
NATURAL+NEOPRENE	C
NEOPRENE/NATURAL	C
NITRILE+PVC	C
HYPALON	C
NAT+NEOPR+NITRILE	C
BUTYL	C
BUTYL/NEOPRENE	C
NITRILE	C
NEOPRENE	C

A: Best selection
B: Satisfactory; may degrade after 4 hours continuous immersion
C: Poor to dangerous choice for other than short-term immersion

PVC.....C

Section 9 - Physical and Chemical Properties

Appearance/General Info: Clear colorless flammable liquid with a strong aromatic odor; floats on water. Mixes with most organic solvents.

Physical State: Liquid
Vapor Pressure (kPa): 0.5 at 15 °C
Vapor Density (Air=1): 3.66 at 15 °C
Formula Weight: 106.18
Specific Gravity (H_2O=1, at 4 °C): 0.87 at 15 °C
Water Solubility: Practically insoluble in water
Evaporation Rate: 0.7 Bu Ac=1
pH: Not applicable

pH (1% Solution): Not applicable.
Boiling Point Range: 137 °C (279 °F) to 140 °C (284 °F)
Freezing/Melting Point Range: -47 °C (-53 °F)
Volatile Component (% Vol): 100

Section 10 - Stability and Reactivity

Stability/Polymerization: Product is considered stable. Hazardous polymerization will not occur.
Storage Incompatibilities: Avoid storage with oxidizers.

Section 11 - Toxicological Information

Unless otherwise specified data extracted from RTECS - Registry of Toxic Effects of Chemical Substances

TOXICITY
Oral (human) LD_{Lo}: 50 mg/kg
Oral (rat) LD_{50}: 4300 mg/kg
Inhalation (human) TC_{Lo}: 200 ppm
Inhalation (man) LC_{Lo}: 10000 ppm/6h
Inhalation (rat) LC_{50}: 5000 ppm/4h
Reproductive effector in rats

IRRITATION
Skin (rabbit):500 mg/24h moderate
Eye (human): 200 ppm irritant
Eye (rabbit): 87 mg mild
Eye (rabbit): 5 mg/24h SEVERE

See NIOSH, *RTECS* ZE 2100000, for additional data.

Section 12 - Ecological Information

Environmental Fate: Most of the xylenes are released into the atmosphere where they may photochemically degrade by reaction with hydroxyl radicals (half-life 1-18 hr). The dominant removal process in water is volatilization. Xylenes are moderately mobile in soil and may leach into groundwater where they are known to persist for several years, despite some evidence that they biodegrade in both soil and groundwater. Bioconcentration is not expected to be significant.
Ecotoxicity: LC_{50} Rainbow trout 13.5 mg/l/96 hr /Conditions of bioassay not specified; LD_{50} Goldfish 13 mg/l/24 hr /Conditions of bioassay not specified
Henry's Law Constant: 0.22
BCF: estimated at 2.14 to 2.20
Octanol/Water Partition Coefficient: log K_{OW} = 3.12 to 3.20
Soil Sorption Partition Coefficient: K_{OC} = 48 to 68

Section 13 - Disposal Considerations

Disposal: Consult manufacturer for recycling options and recycle where possible.
Follow applicable federal, state, and local regulations.
Incinerate residue at an approved site.
Recycle containers where possible, or dispose of in an authorized landfill.

Section 14 - Transport Information

DOT Transportation Data (49 CFR 172.101):

Shipping Name: XYLENES
Additional Shipping Information: XYLOLS
Hazard Class: 3.2
ID No.: 1307
Packing Group: III
Label: Flammable Liquid[3]

Section 15 - Regulatory Information

EPA Regulations:

RCRA 40 CFR: Listed U239 Toxic Waste; Ignitable Waste
CERCLA 40 CFR 302.4: Listed per CWA Section 311(b)(4); per RCRA Section 3001 100 lb (45.35 kg)
SARA 40 CFR 372.65: Listed
SARA EHS 40 CFR 355: Not listed
TSCA: Listed

Section 16 - Other Information

Research Date: .....1999-11 **Review Date:** 2000-07

Disclaimer: Judgments as to the suitability of information herein for the purchaser's purposes are necessarily the purchaser's responsibility. Although reasonable care has been taken in the preparation of such information, Genium Publishing Corporation extends no warranties, makes no representations, and assumes no responsibility as to the accuracy or suitability of such information for application to the purchaser's intended purpose or for consequences of its use.

ARCADIS

Attachment B

Incident/Near Miss Investigation Form

ARCADIS
Infrastructure, environment, buildings

Incident / Near-Miss Investigation Report

☐ OSHA Recordable	☐ First Aid Injury	☐ Fire	Date of Incident:
☐ Lost Workday Injury	☐ Vehicle Accident	☐ Spill / Leak	
☐ Restricted Duty Injury	☐ Equipment Damage	☐ Near Miss	Incident Number:

Every employee injury, accident, and near miss must be reported within 24 hours of the injury. If the incident results in hospitalization, an immediate report must be made by telephone to the Project Manager and the Health and Safety Officer.

Project Information

Project Name: | Project #

Location of Incident:

Employee

Name: | Employee Number:

Employment Status: ☐ Regular ☐ Part Time | How long in present job?

Injury or Illness Information

Where did the incident / near miss occur? (number, street, city, state, zip):

Employee's specific activity at the time of the incident / near miss:

Equipment, materials, or chemicals the employee was using when the incident / near miss occurred (e.g., the equipment employee struck against or that struck the employee; the vapor inhaled or material swallowed; what the employee was lifting, pulling, etc.):

Describe the specific injury or illness (e.g., cut, strain, fracture, etc.):

Body part(s) affected (e.g., back, left wrist, right eye, etc.):

Name and address of treatment provider (e.g., physician or clinic): | Phone No.:

If hospitalized, name and address of hospital: | Phone No.:

Date of injury or onset of illness: / / | Time of event or exposure: ☐ AM ☐ PM

Did employee miss at least one full shift's work? ☐ No ☐ Yes, 1st date absent (MM/DD/YYYY) / /

Has employee returned to work? ☐ Regular work ☐ Restricted work ☐ No
☐ Yes, date returned (MM/DD/YYYY) / /

To whom reported: | Other workers injured / made ill in this event? ☐ Yes ☐ No

Description of Incident / Near Miss: (Describe what happened and how it happened.)

ARCADIS
Infrastructure, environment, buildings

Incident / Near-Miss Investigation Report

Motor Vehicle Accident (MVA)									
		Company Vehicle?	☐ Yes ☐ No						
Accident Location (street, city, state)									
Vehicle Towed?	☐ Yes ☐ No	Other Vehicle?	☐ Yes ☐ No	# Vehicles Towed:		# of Injuries:			

Spill		
Material Spilled:	Quantity:	Source:
Agency Notifications:		
Cost of Incident $		

Third Party Incidents			
Name of Owner:		Address:	Telephone:
Description of Damage:			
Witness Name:		Address:	Telephone:
Witness Name:		Address:	Telephone:

#	Root Cause and Contributing Factors: Conclusion (Describe in Detail Why Incident / Near Miss Occurred)
1	
2	
3	
4	
5	

Root Cause(s) Analysis (RCA):

1. Lack of skill or knowledge.
2. Lack of or inadequate operational procedures or work standards.
3. Inadequate communication of expectations regarding procedures or work standards.
4. Inadequate tools or equipment.
5. Correct way takes more time and / or requires more effort.
6. Short-cutting standard procedures is positively reinforced or tolerated.
7. Person thinks there is no personal benefit to always doing the job according to standards.
8. Uncontrollable.

#	RCA #	Solution(s): How to Prevent Incident / Near Miss From Reoccurring	Person Responsible	Due Date	Closure Date

Investigation Team Members		
Name	Job Title	Date

ARCADIS
Infrastructure, environment, buildings

Incident / Near-Miss Investigation Report

Results of Solution Verification and Validation

Reviewed By

Name	Job Title	Date
	Project Manager	
	Health and Safety Reviewer	