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NJ Health
New Jersey Department of Health

Right to Know
Hazardous Substance Fact Sheet

Common Name: **DIPHENYL**

Synonyms: Biphenyl; Lemonene; Phenyl Benzene
Chemical Name: 1,1'-Biphenyl
Date: December 1998 Revision: January 2009

CAS Number: 92-52-4
RTK Substance Number: 0795
DOT Number: UN 3077

Description and Use

Diphenyl is a colorless, white to yellow, leaf-like or crystalline (sand-like) solid with a pleasant, characteristic odor. It is used as a heat transfer agent, and in plant disease control and making other chemicals.

Reasons for Citation

- **Diphenyl** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

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

Skin Contact
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

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

CARCINOGEN
COMBUSTIBLE
POISONOUS GASES ARE PRODUCED IN FIRE

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

- **Diphenyl** can affect you when inhaled and by passing through the skin
- **Diphenyl** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- Inhaling **Diphenyl** can irritate the nose, throat and lungs.
- **Diphenyl** can cause nausea, vomiting, diarrhea and abdominal pain.
- **Diphenyl** may damage the nervous system.
- Repeated exposure may cause sleeplessness and personality changes.
- Long-term exposure may cause a skin allergy.
- **Diphenyl** may damage the liver and kidneys.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **1 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **1 mg/m^3** averaged over an 8-hour workshift.

- **Diphenyl** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Diphenyl**:

- Contact can irritate the skin and eyes.
- Inhaling **Diphenyl** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Diphenyl** can cause nausea, vomiting, diarrhea and abdominal pain.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Diphenyl** and can last for months or years:

Cancer Hazard

- **Diphenyl** is a PROBABLE CARCINOGEN in humans. There is evidence that *Polychlorinated Biphenyls* cause liver cancer in humans and animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- There is no evidence that **Diphenyl** affects reproduction. This is based on test results presently available to the NJDOH from published studies.

Other Effects

- **Diphenyl** may damage the nervous system causing headache, fatigue, weakness, numbness, muscle twitching and tremors.
- Repeated exposure may cause sleeplessness and personality changes such as depression, anxiety or irritability.
- **Diphenyl** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- Long-term exposure may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- **Diphenyl** may damage the liver and kidneys.

Medical

Medical Testing

For frequent or potentially high exposure (half the PEL or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Lung function tests
- Evaluation by a qualified allergist can help diagnose skin allergy.

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

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

Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Diphenyl**.

Workplace Controls and Practices

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

The following work practices are also recommended:

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

In addition, the following may be useful or required:

- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.
- Where possible, transfer **Diphenyl** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Diphenyl**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl and Neoprene for gloves, and Tyvek®, or the equivalent, as a protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

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

- Where the potential exists for exposure over **1 mg/m^3**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge and particulate prefilters. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Diphenyl**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **10 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **100 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **100 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

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

- **Diphenyl** is a COMBUSTIBLE SOLID and *finely dispersed particles* may form explosive mixtures in air.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.
- Water or foam may cause frothing.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

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

If **Diphenyl** is spilled, take the following steps:

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

Handling and Storage

Prior to working with **Diphenyl** you should be trained on its proper handling and storage.

- **Diphenyl** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and contact may cause fire and explosion.
- Store in tightly closed containers in a cool, well-ventilated area away from SUNLIGHT.
- Sources of ignition, such as smoking and open flames, are prohibited where **Diphenyl** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders
Quick Reference

Common Name: **DIPHENYL**

Synonyms: Biphenyl; Lemonene; Phenyl Benzene
CAS No: 92-52-4
Molecular Formula: $C_{12}H_{10}$
RTK Substance No: 0795

Description: Colorless, white to yellow, leaf-like or crystalline solid with a pleasant, characteristic odor

HAZARD DATA

Hazard Rating

3 - Health
1 - Fire
0 - Reactivity
DOT#: UN 3077
ERG Guide #: 171
Hazard Class: 9
(Miscellaneous Hazardous Material)

Firefighting

Diphenyl is a COMBUSTIBLE SOLID and *finely dispersed particles* may form explosive mixtures in air.

Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.

Water or foam may cause frothing.

POISONOUS GASES ARE PRODUCED IN FIRE.

Use water spray to keep fire-exposed containers cool.

Reactivity

Diphenyl is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and contact may cause fire and explosion.

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.

DO NOT wash into sewer.

Diphenyl is very toxic to aquatic organisms and bioaccumulation may occur.

PHYSICAL PROPERTIES

Odor Threshold:	Pleasant odor
Flash Point:	235°F (113°C)
LEL:	0.6%
UEL:	5.8%
Auto Ignition Temp:	1,004°F (540°C)
Vapor Density:	5.3 (air = 1)
Vapor Pressure:	0.005 mm Hg at 68°F (20°C)
Specific Gravity:	1.2
Water Solubility:	Insoluble
Boiling Point:	489° to 491°F (254° to 255°C)
Melting Point:	156° to 160°F (69° to 71°C)
Ionization Potential:	7.95 eV
Molecular Weight:	154.2

EXPOSURE LIMITS

OSHA:	1 mg/m^3, 8-hr TWA
NIOSH:	1 mg/m^3, 10-hr TWA
ACGIH:	1 mg/m^3, 8-hr TWA
IDLH:	100 mg/m^3

The Protective Action Criteria values are:
PAC-1 = 8 mg/m^3
PAC-2 = 60 mg/m^3
PAC-3 = 100 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl and Neoprene
Coveralls:	Tyvek®
Respirator:	>1 mg/m^3 - Full facepiece APR with Organic vapor cartridge and High efficiency particulate prefilter >8 mg/m^3 - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath Nausea, vomiting and abdominal pain
Chronic:	*Polychlorinated Biphenyls* cause liver cancer in humans and animals.

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

NIOSH®

1,2-DICHLOROETHYLENE

ICSC: 0436

1,2-Dichloroethene Acetylene dichloride symmetrical Dichloroethylene $C_2H_2Cl_2$ / ClCH=CHCl Molecular mass: 96.95 ICSC # 0436 	CAS # 540-59-0 RTECS # KV9360000 UN # 1150 EC # 602-026-00-3 July 05, 2003 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE!	
•INHALATION	Cough. Sore throat. Dizziness. Nausea. Drowsiness. Weakness. Unconsciousness. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.

•EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Remove all ignition sources. Ventilation. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in dry sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. (Extra personal protection: complete protective clothing including self-contained breathing apparatus.)	Fireproof. Well closed. See Chemical Dangers.	Note: C F symbol Xn symbol R: 11-20-52/53 S: 2-7-16-29-61 UN Hazard Class: 3 UN Packing Group: II

ICSC: 0436	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0436

1,2-DICHLOROETHYLENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** The vapour is heavier than air and may travel along the ground; distant ignition possible. **CHEMICAL DANGERS:** The substance decomposes on heating or under the influence of air , light and moisture producing toxic and corrosive fumes including hydrogen chloride . Reacts with strong oxidants. Reacts with copper or copper alloys, and bases to produce toxic chloroacetylene which is spontaneously flammable in contact with air. Attacks plastic. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 200 ppm as TWA; (ACGIH 2003). MAK: 200 ppm, 800 mg/m^3; Peak limitation category: II(2); (DFG 2002). OSHA PEL: TWA 200 ppm (790 mg/m^3) NIOSH REL: TWA 200 ppm (790 mg/m^3) NIOSH IDLH: 1000 ppm See: 540590	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its vapour and by ingestion. **INHALATION RISK:** A harmful contamination of the air will be reached quickly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance is irritating to the eyes and the respiratory tract . The substance may cause effects on the central nervous system at high levels , resulting in lowering of consciousness . **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The liquid defats the skin. The substance may have effects on the liver .
PHYSICAL PROPERTIES	Boiling point: 55°C Relative density (water = 1): 1.28 Solubility in water: poor Relative vapour density (air = 1): 3.34	Flash point: 2°C c.c. Auto-ignition temperature: 460°C Explosive limits, vol% in air: 9.7-12.8 Octanol/water partition coefficient as log Pow: 2

ENVIRONMENTAL DATA	

N O T E S

This compound has two isomers, cis and trans.Data for the isomers: cis-isomer (CAS 156-59-2), trans isomer (CAS 156-60-5), other boiling point 60.3, melting point -81.5°C (cis), -49.4°C (trans); flash point c.c. 6°C (cis), 2-4°C (trans); relative density (water = 1) 1.28 (cis), 1.26 (trans); vapour pressure 24.0 kPa (cis), 35.3 kPa (trans) at 20°C; relative density of the vapour/air-mixture at 20°C (air = 1): 1.6 (cis), 1.8 (trans); octanol/water partition coefficient as log Pow: 1.86 (cis), 2.09 (trans). Depending on the degree of exposure, periodic medical examination is suggested.

Transport Emergency Card: TEC (R)-30GF1-I+II

NFPA Code: H2; F3; R2;

ADDITIONAL INFORMATION

ICSC: 0436 **1,2-DICHLOROETHYLENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

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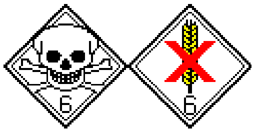
Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries

2,4-DICHLOROPHENOL

ICSC: 0438

2,4-DCP $C_6H_4Cl_2O$ Molecular mass: 163.0 ICSC # 0438 	CAS # 120-83-2 RTECS # SK8575000 UN # 2020 EC # 604-011-00-7 August 04, 1997 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION	Burning sensation. Sore throat. Cough. Shortness of breath.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.
•SKIN	MAY BE ABSORBED! Redness. Pain. Blisters. (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
•EYES	Redness. Pain. Severe deep burns.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION	Burning sensation. Abdominal pain. Tremor. Weakness. Convulsions. Laboured breathing. Shock or collapse.	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Do NOT let this chemical enter the environment. Personal protection: complete protective clothing including self-contained breathing apparatus.	Separated from strong oxidants, food and feedstuffs . Ventilation along the floor.	Do not transport with food and feedstuffs. T symbol N symbol R: 22-24-34-51/53 S: 1/2-26-36/37/39-45-61 UN Hazard Class: 6.1 UN Packing Group: III

ICSC: 0438	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0438

2,4-DICHLOROPHENOL

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS CRYSTALS , WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** The vapour is heavier than air. **CHEMICAL DANGERS:** On combustion, forms corrosive gases (hydrogen chloride). Upon heating, toxic fumes are formed. Reacts violently with strong oxidants . **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion. **INHALATION RISK:** No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** Corrosive. The substance is corrosive to the eyes, the skin and the respiratory tract. Corrosive on ingestion. Exposure to high level may result in death. Exposure to small amounts of the molten or liquid form of the substance may result in extensive skin absorption and rapid death. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 210.0°C Melting point: 45.0°C Solubility in water, g/100 ml at 20°C: 0.5 Vapour pressure, kPa at 53°C: 133	Relative vapour density (air = 1): 5.6 Flash point: 114°C o.c. Octanol/water partition coefficient as log Pow: 3.06

ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms.

NOTES

Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

Transport Emergency Card: TEC (R)-61S2020

NFPA Code: H; F1; R0.

ADDITIONAL INFORMATION

ICSC: 0438 **2,4-DICHLOROPHENOL**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

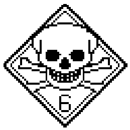
Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries
NIOSH®

2,4-DINITROTOLUENE

ICSC: 0727

1-Methyl-2,4-dinitrobenzene 2,4-DNT $C_7H_6N_2O_4$ / $C_6H_3CH_3(NO_2)_2$ Molecular mass: 182.1 ICSC # 0727 	CAS # 121-14-2 RTECS # XT1575000 UN # 3454 EC # 609-007-00-9 April 21, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air. Risk of explosion on contact with many substances.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
•INHALATION	Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.

•SKIN	MAY BE ABSORBED! (See Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
•EYES		Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(See Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Consult an expert! Personal protection: chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Fireproof. Separated from strong bases,food and feedstuffsoxidants,strong reducing agents. Well closed. Keep in a well-ventilated room. Store in an area without drain or sewer access.	Do not transport with food and feedstuffs. Note: E T symbol N symbol R: 45-23/24/25-48/22-62-68-51/53 S: 53-45-61 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0727	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0727

2,4-DINITROTOLUENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
YELLOW CRYSTALS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
May explode on heating. The substance decomposes on heating producing toxic and corrosive fumesincluding nitrogen oxides even in absence of air. Reacts with reducing agents , strong bases and oxidants causing explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.2 mg/m^3 as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2005).
MAK: skin absorption (H);
Carcinogen category: 2;
(DFG 2004).
TLV and MAK are for mixed isomers (CAS 25321-14-6)

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the blood , resulting in formation of methaemoglobin. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the blood , resulting in formation of methaemoglobin. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES	Boiling point (decomposes): >250° C Melting point: 71°C Density: 1.52 g/cm^3 Solubility in water: very poor	Vapour pressure, Pa at 25°C: 0.02 Relative vapour density (air = 1): 6.28 Flash point: 169°C c.c. Octanol/water partition coefficient as log Pow: 1.98
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms.	

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Do NOT take working clothes home. UN number for molten form: UN1600, TEC (R): 61GT1-II

Transport Emergency Card: TEC (R)-61S3454; 61GT2-II

NFPA Code: H3; F1; R3;

ADDITIONAL INFORMATION

ICSC: 0727 **2,4-DINITROTOLUENE**

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Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

NJ Health
New Jersey Department of Health

Right to Know
Hazardous Substance Fact Sheet

Common Name: **2,4-DIMETHYLPHENOL**

Synonym: m-Xylenol
Chemical Name: Phenol, 2,4-Dimethyl-
Date: November 1998 Revision: January 2009

CAS Number: 105-67-9
RTK Substance Number: 0764
DOT Number: UN 2261

Description and Use

2,4-Dimethylphenol is a colorless, crystalline (sand-like) solid or a yellow-brown liquid. It is used in making pharmaceuticals, insecticides, fungicides, dye stuffs, rubber chemicals, and plastics.

Reasons for Citation

- **2,4-Dimethylphenol** is on the Right to Know Hazardous Substance List because it is cited by DOT, DEP, IRIS and EPA.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

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

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	-
FLAMMABILITY	1	-
REACTIVITY	0	-
COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **2,4-Dimethylphenol** can affect you when inhaled and by passing through the skin.
- Contact can irritate and burn the skin and eyes.
- Inhaling **2,4-Dimethylphenol** can irritate the nose, throat and lungs.
- Exposure to **2,4-Dimethylphenol** can cause headache, weakness, nausea and vomiting.
- High or repeated exposure may affect the liver and kidneys.

Workplace Exposure Limits

No occupational exposure limits have been established for **2,4-Dimethylphenol**. However, it may pose a health risk. Always follow safe work practices.

- It should be recognized that **2,4-Dimethylphenol** can be absorbed through your skin, thereby increasing your exposure.

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **2,4-Dimethylphenol**:

- Contact can irritate and burn the skin and eyes.
- Inhaling **2,4-Dimethylphenol** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- Exposure to **2,4-Dimethylphenol** can cause headache, weakness, nausea and vomiting.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **2,4-Dimethylphenol** and can last for months or years:

Cancer Hazard

- While **2,4-Dimethylphenol** has been tested, further testing is required to assess its potential to cause cancer.

Reproductive Hazard

- According to the information presently available to the New Jersey Department of Health, **2,4-Dimethylphenol** has not been tested for its ability to affect reproduction.

Other Effects

- **2,4-Dimethylphenol** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- High or repeated exposure may affect the liver and kidneys.

Medical

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

- Lung function tests
- Liver and kidney function tests

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

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

Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **2,4-Dimethylphenol**.

Workplace Controls and Practices

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

The following work practices are also recommended:

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

In addition, the following may be useful or required:

- For *solid* **2,4-Dimethylphenol** use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Where possible, transfer **2,4-Dimethylphenol** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **2,4-Dimethylphenol**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl, Nitrile and Viton as glove materials for *aromatic Phenols*, and Tychem® BR, LV, Responder® and TK, or the equivalent, as protective materials for *aromatic Phenols*.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- For *solid* **2,4-Dimethylphenol** wear eye protection with side shields or goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

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

- Where the potential exists for exposure to **2,4-Dimethylphenol**, use a NIOSH approved full facepiece respirator with an organic vapor/acid gas cartridge, and particulate prefilters, which is specifically approved for **2,4-Dimethylphenol**. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **2,4-Dimethylphenol**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

Fire Hazards

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

- **2,4-Dimethylphenol** is a COMBUSTIBLE LIQUID or SOLID.
- Use dry chemical, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- **2,4-Dimethylphenol** can be ignited by static discharge or sparks.

Spills and Emergencies

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

If **2,4-Dimethylphenol** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Collect solid material in the most convenient and safe manner and place into sealed containers for disposal.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **2,4-Dimethylphenol** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **2,4-Dimethylphenol** you should be trained on its proper handling and storage.

- **2,4-Dimethylphenol** may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) resulting in fires.
- **2,4-Dimethylphenol** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ACID CHLORIDES; ACID ANHYDRIDES; and AMMONIA.
- Store in tightly closed containers in a cool, well-ventilated area away from METALS (such as STEEL, BRASS, COPPER, and COPPER ALLOYS).
- Sources of ignition, such as smoking and open flames, are prohibited where **2,4-Dimethylphenol** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **2,4-DIMETHYLPHENOL**

Synonym: m-Xylenol
CAS No: 105-67-9
Molecular Formula: $C_8H_{10}O$
RTK Substance No: 0764
Description: Colorless, crystalline solid or yellow-brown liquid

HAZARD DATA

Hazard Rating

2 - Health

1 - Fire

0 - Reactivity

DOT#: UN 2261

ERG Guide #: 153

Hazard Class: 6.1 (Poison)

Firefighting

2,4-Dimethylphenol is a COMBUSTIBLE LIQUID or SOLID.

Use dry chemical, water spray or foam as extinguishing agents.

POISONOUS GASES ARE PRODUCED IN FIRE.

Use water spray to keep fire-exposed containers cool.

2,4-Dimethylphenol can be ignited by static discharge or sparks.

Reactivity

2,4-Dimethylphenol may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) resulting in fires.

2,4-Dimethylphenol is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ACID CHLORIDES; ACID ANHYDRIDES; and AMMONIA.

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

Collect solid material in the most convenient and safe manner and place into sealed containers for disposal.

DO NOT wash into sewer.

2,4-Dimethylphenol is toxic to aquatic organisms and may bioaccumulate.

PHYSICAL PROPERTIES

Flash Point:	>230°F (>110°C)
LEL:	1.1%
UEL:	6.4%
Auto Ignition Temp:	1,110°F (599°C)
Vapor Pressure:	0.062 mm Hg at 68°F (20°C)
Specific Gravity:	0.97 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	413°F (212°C)
Melting Point:	78° to 79°F (25° to 26°C)
Ionization Potential:	8 +/- 0.2 eV
Molecular Weight:	122.2

EXPOSURE LIMITS

The Protective Action Criteria values are:

PAC-1 = 1 mg/m^3
PAC-2 = 6 mg/m^3
PAC-3 = 500 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Nitrile and Viton (>8-hr breakthrough for *aromatic Phenols*)
Coveralls:	Tychem® BR, LV, Responder® and TK (>8-hr breakthrough for *aromatic Phenols*)
Respirator:	>1 mg/m^3 - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath Headache, nausea and vomiting

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

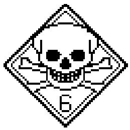
January 2009

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries
NIOSH®

2,6-DINITROTOLUENE

ICSC: 0728

1-Methyl-2,6-dinitrobenzene 2,6-DNT $C_7H_6N_2O_4$ / $C_6H_3CH_3(NO_2)_2$ Molecular mass: 182.1 ICSC # 0728 	CAS # 606-20-2 RTECS # XT1925000 UN # 3454 EC # 609-049-00-8 April 21, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air. Risk of explosion on contact with many substances.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION	Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Unconsciousness.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.

•SKIN	MAY BE ABSORBED! (See Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
•EYES		Face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(See Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Consult an expert! Personal protection: chemical protection suit including self-contained breathing apparatus. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Fireproof. Separated from strong bases,food and feedstuffsoxidants,strong reducing agents. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. Note: E T symbol R: 45-23/24/25-48/22-62-68-52/53 S: 53-45-61 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0728	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0728

2,6-DINITROTOLUENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
YELLOW , BROWN TO RED CRYSTALS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
May explode on heating. The substance decomposes on heating producing toxic and corrosive fumesincluding nitrogen oxides even in absence of air. Reacts with reducing agents , strong bases and oxidants causing explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.2 mg/m^3 as TWA; (skin); A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK: skin absorption (H); Carcinogen category: 2; (DFG 2004).
TLV and MAK are for mixed isomers (CAS 25321-14-6)

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the blood , resulting in formation of methaemoglobin. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the blood , resulting in formation of methaemoglobin. This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point (decomposes): 285°C
Melting point: 66°C
Relative density (water = 1): 1.283 (liquid)
Solubility in water: very poor
Vapour pressure, Pa at 20°C: 2.4
Relative vapour density (air = 1): 6.28
Flash point: 207°C c.c.
Octanol/water partition coefficient as log Pow: 2.05

ENVIRONMENTAL DATA	

N O T E S

Depending on the degree of exposure, periodic medical examination is suggested. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Do NOT take working clothes home. UN number for molten form: UN1600. See also ICSC0465 Dinitrotoluene (mixed isomers).

Transport Emergency Card: TEC (R)-61S3454; 61GT2-II

NFPA Code: H3; F1; R3;

ADDITIONAL INFORMATION

ICSC: 0728 **2,6-DINITROTOLUENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Material Safety Data Sheet

Version 5.2
Revision Date 12/06/2012
Print Date 02/06/2014

1. PRODUCT AND COMPANY IDENTIFICATION

Product name : 2-Amino-4,6-dinitrotoluene

Product Number : ERA-017
Brand :

2. HAZARDS IDENTIFICATION

Emergency Overview

OSHA Hazards

Toxic by inhalation., Toxic by ingestion, Toxic by skin absorption

GHS Classification

Acute toxicity, Oral (Category 3)
Acute toxicity, Inhalation (Category 3)
Acute toxicity, Dermal (Category 3)
Specific target organ toxicity - repeated exposure (Category 2)
Acute aquatic toxicity (Category 2)
Chronic aquatic toxicity (Category 2)

GHS Label elements, including precautionary statements

Pictogram

Signal word Danger

Hazard statement(s)

H301 + H311 + H331	Toxic if swallowed, in contact with skin or if inhaled
H373	May cause damage to organs through prolonged or repeated exposure.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P261	Avoid breathing dust/ fume/ gas/ mist/ vapours/ spray.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing.
P301 + P310	IF SWALLOWED: Immediately call a POISON CENTER or doctor/ physician.
P311	Call a POISON CENTER or doctor/ physician.

HMIS Classification

Health hazard: 2
Flammability: 0
Physical hazards: 0

NFPA Rating

Health hazard: 2
Fire: 0

Reactivity Hazard: 0

Potential Health Effects

Inhalation	Toxic if inhaled. May cause respiratory tract irritation.
Skin	Toxic if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.
Ingestion	Toxic if swallowed.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Molecular Weight : 197.15 g/mol

Component		Concentration
2-Methyl-3,5-dinitro-benzenamine		
CAS-No.	35572-78-2	-
Index-No.	612-025-00-X	

4. FIRST AID MEASURES

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

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

In case of skin contact
Wash off with soap and plenty of water. Take victim immediately to hospital. Consult a physician.

In case of eye contact
Flush eyes with water as a precaution.

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

5. FIREFIGHTING MEASURES

Conditions of flammability
Not flammable or combustible.

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

Special protective equipment for firefighters
Wear self contained breathing apparatus for fire fighting if necessary.

Hazardous combustion products
Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NOx)

6. ACCIDENTAL RELEASE MEASURES

Personal precautions
Wear respiratory protection. Avoid dust formation. Avoid breathing vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

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

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

7. HANDLING AND STORAGE

Precautions for safe handling
Avoid contact with skin and eyes. Avoid formation of dust and aerosols.
Provide appropriate exhaust ventilation at places where dust is formed.

Conditions for safe storage
Keep container tightly closed in a dry and well-ventilated place.

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8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Contains no substances with occupational exposure limit values.

Personal protective equipment

Respiratory protection
Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N99 (US) or type P2 (EN 143) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

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

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

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

Hygiene measures
Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

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9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance

Form	solid
Colour	no data available

Safety data

pH	no data available
Melting point/freezing point	no data available
Boiling point	no data available
Flash point	no data available
Ignition temperature	no data available
Auto-ignition temperature	no data available
Lower explosion limit	no data available
Upper explosion limit	no data available
Vapour pressure	no data available
Density	no data available
Water solubility	no data available
Partition coefficient: n-octanol/water	log Pow: 0.168
Relative vapor density	no data available
Odour	no data available

Odour Threshold	no data available
Evaporation rate	no data available

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10. STABILITY AND REACTIVITY

Chemical stability
Stable under recommended storage conditions.

Possibility of hazardous reactions
no data available

Conditions to avoid
no data available

Materials to avoid
Strong oxidizing agents

Hazardous decomposition products
Other decomposition products - no data available
Hazardous decomposition products formed under fire conditions. - Carbon oxides, nitrogen oxides (NOx)

---

11. TOXICOLOGICAL INFORMATION

Acute toxicity

Oral LD50
no data available

Inhalation LC50
no data available

Dermal LD50
no data available

Other information on acute toxicity
no data available

Skin corrosion/irritation
no data available

Serious eye damage/eye irritation
no data available

Respiratory or skin sensitization
no data available

Germ cell mutagenicity
no data available

Carcinogenicity

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

Reproductive toxicity

no data available

Teratogenicity

no data available

Specific target organ toxicity - single exposure (Globally Harmonized System)
no data available

Specific target organ toxicity - repeated exposure (Globally Harmonized System)
May cause damage to organs through prolonged or repeated exposure.

Aspiration hazard
no data available

Potential health effects

Inhalation	Toxic if inhaled. May cause respiratory tract irritation.
Ingestion	Toxic if swallowed.
Skin	Toxic if absorbed through skin. May cause skin irritation.
Eyes	May cause eye irritation.

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

Synergistic effects
no data available

Additional Information
RTECS: Not available

12. ECOLOGICAL INFORMATION

Toxicity

no data available

Persistence and degradability
no data available

Bioaccumulative potential
no data available

Mobility in soil
no data available

PBT and vPvB assessment
no data available

Other adverse effects

Toxic to aquatic life with long lasting effects.

An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.

13. DISPOSAL CONSIDERATIONS

Product
Offer surplus and non-recyclable solutions to a licensed disposal company. Contact a licensed professional waste disposal service to dispose of this material. Dissolve or mix the material with a combustible solvent and burn in a chemical incinerator equipped with an afterburner and scrubber.

Contaminated packaging
Dispose of as unused product.

14. TRANSPORT INFORMATION

DOT (US)
Not dangerous goods

IMDG
Not dangerous goods

IATA
Not dangerous goods

15. REGULATORY INFORMATION

OSHA Hazards
Toxic by inhalation., Toxic by ingestion, Toxic by skin absorption

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

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

SARA 311/312 Hazards
Acute Health Hazard

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

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
2-Methyl-3,5-dinitro-benzenamine	35572-78-2	

New Jersey Right To Know Components

	CAS-No.	Revision Date
2-Methyl-3,5-dinitro-benzenamine	35572-78-2	

California Prop. 65 Components
This product does not contain any chemicals known to State of California to cause cancer, birth defects, or any other reproductive harm.

16. OTHER INFORMATION

Further information

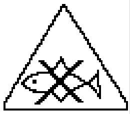
The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product.

Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

2-METHYLNAPHTHALENE

ICSC: 1276

beta-Methylnaphthalene $C_{11}H_{10}$ Molecular mass: 142.2 ICSC # 1276 	CAS # 91-57-6 RTECS # QJ9635000 September 10, 1997 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder , foam , carbon dioxide .
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough.	Local exhaust.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Store in an area without drain or sewer access.	Marine pollutant.

ICSC: 1276	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1276

2-METHYLNAPHTHALENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** CRYSTALS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance decomposes on heating producing acrid smoke and irritating fumes. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 0.5 ppm as TWA; (skin); A4 (not classifiable as a human carcinogen); (ACGIH 2008). MAK not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and by ingestion. **INHALATION RISK:** No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance irritates the eyes. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Lungs may be affected by repeated or prolonged exposure.
PHYSICAL PROPERTIES	Boiling point: 241°C Melting point: 35°C Relative density (water = 1): 1.00	Solubility in water, g/100 ml at 25°C: 0.003 Vapour pressure, Pa at °C: 9 Octanol/water partition coefficient as log Pow: 3.86

ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.

NOTES

Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.

Card has been partially updated in February 2009: see Occupational Exposure Limits,

ADDITIONAL INFORMATION

ICSC: 1276 **2-METHYLNAPHTHALENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

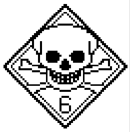
Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries

3-NITROANILINE

ICSC: 0307

m-Nitroaniline 1-Amino-3-nitrobenzene C.I. 37030 $C_6H_6N_2O_2$ Molecular mass: 138.1 ICSC # 0307 	CAS # 99-09-2 RTECS # BY6825000 UN # 1661 EC # 612-012-00-9 December 03, 2001 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Many reactions may cause fire or explosion.	NO open flames. NO contact with combustible substances.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	In case of fire: keep drums, etc., cool by spraying with water. Combat fire from a sheltered position.
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Blue lips or finger nails. Blue skin. Headache. Dizziness. Nausea. Confusion. Convulsions. Laboured breathing. Unconsciousness.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.

•SKIN	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
•EYES		Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(Further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder. (Extra personal protection: P3 filter respirator for toxic particles.) Do NOT let this chemical enter the environment.	Separated from strong acids, strong oxidants, combustible and reducing substances, food and feedstuffs . Dry.	Do not transport with food and feedstuffs. Note: C T symbol R: 23/24/25-33-52/53 S: 1/2-28-36/37-45-61 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0307	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0307

3-NITROANILINE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** On combustion, forms toxic fumes of nitrogen oxides. Reacts with strong acids , strong oxidants and strong reducing agents . Reacts with organic materials in presence of moisture causing fire hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion. **INHALATION RISK:** No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance may cause effects on the blood , resulting in formation of methaemoglobin. Medical observation is indicated. The effects may be delayed. See Notes. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the blood , resulting in the formation of methaemoglobin. See Notes.
PHYSICAL PROPERTIES	Boiling point (decomposes): 306°C Melting point: 114°C Density: 1.4 g/cm^3	Solubility in water, g/100 ml at 25°C: 0.089 Vapour pressure, Pa at 25°C: 0.005 Octanol/water partition coefficient as log Pow: 1.37

ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms. Do not let this chemical enter the environment.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Also consult ICSC 0306 2-Nitroaniline, and ICSC 0308 4-Nitroaniline.

Transport Emergency Card: TEC (R)-61G12b

NFPA Code: H3; F1; R2;

ADDITIONAL INFORMATION

ICSC: 0307 **3-NITROANILINE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **4-CHLOROPHENYL PHENYL ETHER**

CAS Number: 7005-72-3
DOT Number: UN 3271

RTK Substance number: 2957
Date: December 2002

HAZARD SUMMARY

- * **4-Chlorophenyl Phenyl Ether** can affect you when breathed in.
- * Contact may irritate the skin and eyes.
- * Breathing **4-Chlorophenyl Phenyl Ether** may irritate the nose and throat.

IDENTIFICATION

4-Chlorophenyl Phenyl Ether is a pale yellow liquid with an *Ether*-like odor. It is used as a dielectric fluid.

REASON FOR CITATION

- * **4-Chlorophenyl Phenyl Ether** is on the Hazardous Substance List because it is cited by DOT and EPA.
- * Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- * Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- * If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **4-Chlorophenyl Phenyl Ether**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

WAYS OF REDUCING EXPOSURE

- * Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- * Wear protective work clothing.
- * Wash thoroughly immediately after exposure to **4-Chlorophenyl Phenyl Ether** and at the end of the workshift.
- * Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **4-Chlorophenyl Phenyl Ether** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **4-Chlorophenyl Phenyl Ether**:

* Contact may irritate the skin and eyes.

* Breathing **4-Chlorophenyl Phenyl Ether** may irritate the nose and throat.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **4-Chlorophenyl Phenyl Ether** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **4-Chlorophenyl Phenyl Ether** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **4-Chlorophenyl Phenyl Ether** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **4-Chlorophenyl Phenyl Ether** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

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

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically pump liquid **4-Chlorophenyl Phenyl Ether** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **4-Chlorophenyl Phenyl Ether** should change into clean clothing promptly.

* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **4-Chlorophenyl Phenyl Ether**.

* Eye wash fountains should be provided in the immediate work area for emergency use.

* If there is the possibility of skin exposure, emergency shower facilities should be provided.

* On skin contact with **4-Chlorophenyl Phenyl Ether**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **4-Chlorophenyl Phenyl Ether**, whether or not known skin contact has occurred.

* Do not eat, smoke, or drink where **4-Chlorophenyl Phenyl Ether** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

* Avoid skin contact with **4-Chlorophenyl Phenyl Ether**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear indirect-vent, impact and splash resistant goggles when working with liquids.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential for overexposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **4-CHLOROPHENYL PHENYL ETHER**
DOT Number: **UN 3271**
NAERG Code: **127**
CAS Number: **7005-72-3**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	2	-
REACTIVITY	0	-
COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

FIRE HAZARDS

- **4-Chlorophenyl Phenyl Ether** is a COMBUSTIBLE LIQUID.
- Use dry chemical, CO_2, or alcohol resistant foam extinguishers.
- POISONOUS GASES ARE PRODUCED IN FIRE including *Hydrogen Chloride*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **4-Chlorophenyl Phenyl Ether** is spilled or leaked, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- Remove all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **4-Chlorophenyl Phenyl Ether** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE

- Prior to working with **4-Chlorophenyl Phenyl Ether** you should be trained on its proper handling and storage.
- **4-Chlorophenyl Phenyl Ether** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area away from LIGHT.
- Sources of ignition, such as smoking and open flames, are prohibited where **4-Chlorophenyl Phenyl Ether** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

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

Breathing

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

PHYSICAL DATA

Flash Point: greater than 230°F (110°C)

OTHER COMMONLY USED NAMES

Chemical Name:

4-Chlorophenyl Phenyl Ether

Other Names:

Benzene, 1-Chloro-4-Phenoxy-; Ether, p-Chlorophenyl Phenyl

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **4-NITROPHENOL**

CAS Number: 100-02-7
DOT Number: UN 1663

RTK Substance number: 1390
Date: March 1998 Revision: September 2004

HAZARD SUMMARY

* **4-Nitrophenol** can affect you when breathed in and by passing through your skin.
* Contact can irritate and burn the skin and eyes with possible eye damage.
* Breathing **4-Nitrophenol** can irritate the nose, throat and lungs causing coughing and/or shortness of breath.
* High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.
* Exposure to **4-Nitrophenol** can cause upset stomach, weakness, confusion, rapid heartbeat and/or fever.
* High or repeated exposure may affect the nervous system.
* **4-Nitrophenol** is a REACTIVE CHEMICAL and an EXPLOSION HAZARD.

IDENTIFICATION

4-Nitrophenol is a colorless to slightly yellow, crystalline (sand-like) material. It is used to make drugs, fungicides and insecticides, and in dyes to darken leather.

REASON FOR CITATION

* **4-Nitrophenol** is on the Hazardous Substance List because it is cited by DOT, DEP, IRIS, NFPA and EPA.
* This chemical is on the Special Health Hazard Substance List because it is **REACTIVE**.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **4-Nitrophenol**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

* It should be recognized that **4-Nitrophenol** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **4-Nitrophenol** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **4-Nitrophenol** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **4-Nitrophenol**:

* Contact can irritate and burn the skin and eyes with possible eye damage.
* Breathing **4-Nitrophenol** can irritate the nose, throat and lungs causing coughing and/or shortness of breath.
* High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.
* Exposure to **4-Nitrophenol** can cause upset stomach, weakness, confusion, rapid heartbeat and/or fever.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **4-Nitrophenol** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **4-Nitrophenol** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **4-Nitrophenol** has been tested and has not been shown to affect reproduction.

Other Long-Term Effects

* **4-Nitrophenol** can irritate the lungs. Repeated exposure may cause bronchitis to develop with cough, phlegm, and/or shortness of breath.
* High or repeated exposure may affect the nervous system.

MEDICAL

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Blood methemoglobin level.
* Lung function tests.
* Exam of the nervous system.

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

* Because smoking can cause heart disease, as well as lung cancer, emphysema, and other respiratory problems, it may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **4-Nitrophenol** from drums or other storage containers to process containers.
* Before entering a confined space where **4-Nitrophenol** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **4-Nitrophenol** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **4-Nitrophenol**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **4-Nitrophenol**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **4-Nitrophenol**, whether or not known skin contact has occurred.

- Do not eat, smoke, or drink where **4-Nitrophenol** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

- Avoid skin contact with **4-Nitrophenol**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- Safety equipment manufacturers recommend *Butyl Rubber* as a protective material.

Eye Protection

- Wear eye protection with side shields or goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
- If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **4-Nitrophenol**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q:	If I have acute health effects, will I later get chronic health effects?
A:	Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.
Q:	Can I get long-term effects without ever having short-term effects?
A:	Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.
Q:	What are my chances of getting sick when I have been exposed to chemicals?
A:	The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.
Q:	When are higher exposures more likely?
A:	Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).
Q:	Is the risk of getting sick higher for workers than for community residents?
A:	Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

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Medical Evaluation

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Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

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

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **4-NITROPHENOL**
DOT Number: **UN 1663**
NAERG Code: **153**
CAS Number: **100-02-7**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	1
REACTIVITY	-	2
POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

FIRE HAZARDS

- **4-Nitrophenol** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray, or an alcohol-resistant foam or other foaming agent.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Nitrogen Oxides*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- **4-Nitrophenol** may ignite combustibles (wood, paper and oil).
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **4-Nitrophenol** is spilled, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- Remove all ignition sources.
- Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- Keep **4-Nitrophenol** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
- It may be necessary to contain and dispose of **4-Nitrophenol** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE

- Prior to working with **4-Nitrophenol** you should be trained on its proper handling and storage.
- **4-Nitrophenol** is not compatible with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); DIETHYL PHOSPHITE; and ORGANICS.
- Store in tightly closed containers in a cool, well-ventilated area away from HEAT and COMBUSTIBLES.
- Sources of ignition, such as smoking and open flames, are prohibited where **4-Nitrophenol** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of water.

Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 0.001 mm Hg at 77°F (25°C)
Flash Point: 378°F (192°C)
Water Solubility: Slightly soluble

OTHER COMMONLY USED NAMES

Chemical Name:

Phenol, 4-Nitro-

Other Names:

p-Nitrophenol; Niphen; Paranitrophenol; 4-Hydroxynitrobenzene

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NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **NITROTOLUENES**

CAS Number: 1321-12-6
DOT Number: UN 1664

RTK Substance number: 1398
Date: August 1999

HAZARD SUMMARY

- **Nitrotoluenes** can affect you when breathed in and by passing through your skin.
- Contact can irritate and burn the skin and eyes.
- Breathing **Nitrotoluenes** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Nitrotoluenes** can cause headache, flushing of the face, rapid heartbeat, nausea, vomiting, weakness, irritability, convulsions, coma and death.
- High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.
- Repeated exposure may cause low red blood cell count (anemia).
- **Nitrotoluenes** may damage the liver and kidneys.

IDENTIFICATION

Nitrotoluenes are yellow, oily liquids or yellow, crystalline (sand-like) solids with a bitter almond-like odor. They are a mixture of the *ortho, meta,* and *para-isomers* of **Nitrotoluene**. **Nitrotoluenes** are used in the manufacture of dyes, rubber, agricultural chemicals, explosives, and other chemicals.

REASON FOR CITATION

- **Nitrotoluenes** are on the Hazardous Substance List because they are regulated by OSHA and cited by ACGIH, DOT, NIOSH, NTP, IARC, NFPA and EPA.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA:	The legal airborne permissible exposure limit (PEL) is **5 ppm** averaged over an 8-hour workshift.
NIOSH:	The recommended airborne exposure limit is **2 ppm** averaged over a 10-hour workshift.
ACGIH:	The recommended airborne exposure limit is **2 ppm** averaged over an 8-hour workshift.

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Nitrotoluenes** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Nitrotoluenes** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Nitrotoluenes**:

* Contact can irritate and burn the skin and eyes.
* Breathing **Nitrotoluenes** can irritate the nose and throat causing coughing and wheezing.
* Exposure to **Nitrotoluenes** can cause headache, flushing of the face, rapid heartbeat, nausea, vomiting, weakness, irritability, convulsions, coma and death.
* High levels can interfere with the ability of the blood to carry *Oxygen* causing headache, fatigue, dizziness, and a blue color to the skin and lips (*methemoglobinemia*). Higher levels can cause trouble breathing, collapse and even death.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Nitrotoluenes** and can last for months or years:

Cancer Hazard

* There is limited evidence that **Nitrotoluenes** causes cancer in animals.
* Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

* **Nitrotoluenes** may damage the testes (male reproductive glands).

Other Long-Term Effects

* Repeated exposure may cause low red blood cell count (anemia).
* **Nitrotoluenes** may damage the liver and kidneys.

MEDICAL

Medical Testing

Before beginning employment and at regular times after that, for those with frequent or potentially high exposures, the following are recommended:

* Complete blood cell count.
* Blood methemoglobin level.
* Liver and kidney function tests.

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol may increase the liver damage caused by **Nitrotoluenes**.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Nitrotoluenes** or pump liquid **Nitrotoluenes** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Nitrotoluenes** should change into clean clothing promptly.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Nitrotoluenes**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Nitrotoluenes**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Nitrotoluenes**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Nitrotoluenes** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.

* For solid **Nitrotoluenes**, use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

* Avoid skin contact with **Nitrotoluenes**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.

* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear impact resistant eye protection with side shields or goggles.

* Wear indirect-vent, impact and splash resistant goggles when working with liquids.

* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* Where the potential exists for exposure over **2 ppm**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

* Exposure to **200 ppm** is immediately dangerous to life and health. If the possibility of exposure above **200 ppm** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

* Prior to working with **Nitrotoluenes** you should be trained on its proper handling and storage.

* **Nitrotoluenes** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).

* Store in tightly closed containers in a cool, well-ventilated area and protect from SHOCK.

* Sources of ignition, such as smoking and open flames, are prohibited where **Nitrotoluenes** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?
A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Should I be concerned if a chemical causes cancer in animals?
A: Yes. Most scientists agree that a chemical that causes cancer in animals should be treated as a suspected human carcinogen unless proven otherwise.

Q: But don't they test animals using much higher levels of a chemical than people usually are exposed to?
A: Yes. That's so effects can be seen more clearly using fewer animals. But high doses alone don't cause cancer unless it's a cancer agent. In fact, a chemical that causes cancer in animals at high doses could cause cancer in humans exposed to low doses.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?
A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?
A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 292-5677 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

MSHA is the Mine Safety and Health Administration, the federal agency that regulates mining. It also evaluates and approves respirators.

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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

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

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

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

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **NITROTOLUENES**
DOT Number: **UN 1664**
NAERG Code: **152**
CAS Number: **1321-12-6**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	1
REACTIVITY	-	1
COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

FIRE HAZARDS

* **Nitrotoluenes** is a COMBUSTIBLE LIQUID.
* Use dry chemical, CO_2, water spray, or foam extinguishers.
* POISONOUS GASES ARE PRODUCED IN FIRE, including *Nitrogen Oxides*.
* CONTAINERS MAY EXPLODE IN FIRE.
* Use water spray to keep fire-exposed containers cool.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If liquid **Nitrotoluenes** is spilled or leaked or solid **Nitrotoluenes** is spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
* Remove all ignition sources.
* Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate area after clean-up is complete
* It may be necessary to contain and dispose of **Nitrotoluenes** as a HAZARDOUS WASTE. Contact your Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: (609) 292-7172

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HANDLING AND STORAGE (See page 3)

FIRST AID

In NJ, POISON INFORMATION 1-800-764-7661

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

Skin Contact

* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.
* If exposure and/or symptoms have occurred, the person should be under medical observation for several days as some symptoms may be delayed.

PHYSICAL DATA

Vapor Pressure: 0.1 mm Hg at 68°F (20°C)
Flash Point: 214°F (101°C) to 223°F (106°C)
Water Solubility: Slightly soluble

OTHER COMMONLY USED NAMES

The information contained in this fact sheet is applicable to:

m-Nitrotoluene	CAS # 99-08-1
p-Nitrotoluene	CAS # 99-99-0
o-Nitrotoluene	CAS # 88-72-2

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NEW JERSEY DEPARTMENT OF HEALTH AND
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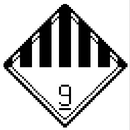
Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

ACENAPHTHENE

ICSC: 1674

1,2-Dihydroacenaphthylene 1,8-Ethylenenaphthalene $C_{12}H_{10}$ Molecular mass: 154.2 ICSC # 1674 	CAS # 83-32-9 RTECS # AB1000000 UN # 3077 October 12, 2006 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray. Dry powder. Foam. Carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE	See NOTES.	PREVENT DISPERSION OF DUST!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety goggles	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: P2 filter respirator for harmful particles. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Separated from strong oxidants . Provision to contain effluent from fire extinguishing. Store in an area without drain or sewer access.	UN Hazard Class: 9 UN Packing Group: III Signal: Warning Enviro Very toxic to aquatic life with long lasting effects

ICSC: 1674	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1674

ACENAPHTHENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE TO BEIGE CRYSTALS

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
On combustion, forms toxic gases including carbon monoxide. Reacts with strong oxidants .

OCCUPATIONAL EXPOSURE LIMITS:
TLV not established.
MAK not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed .

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
See Notes.

PHYSICAL PROPERTIES	Boiling point: 279°C Melting point: 95°C Density: 1.2 g/cm^3 Solubility in water, g/100 ml at 25°C: 0.0004	Vapour pressure, Pa at 25°C: 0.3 Relative vapour density (air = 1): 5.3 Flash point: 135°C o.c. Auto-ignition temperature: >450 °C Octanol/water partition coefficient as log Pow: 3.9 - 4.5
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment. It is strongly advised that this substance does not enter the environment.	

NOTES

Acenaphthene occurs as a pure substance and also as a component of polyaromatic hydrocarbon (PAH) mixtures. Human population studies have associated PAH's exposure with cancer and cardiovascular diseases. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.

Transport Emergency Card: TEC (R)-90GM7-III

ADDITIONAL INFORMATION

ICSC: 1674 **ACENAPHTHENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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ACENAPHTHYLENE

Chemical Identifiers | Hazards | Response Recommendations | Physical Properties | Regulatory Information | Alternate Chemical Names

Chemical Identifiers

What is this information?

CAS Number	UN/NA Number	DOT Hazard Label	CHRIS Code
208-96-8	none	data unavailable	none

NFPA 704

data unavailable

General Description

Colorless crystalline solid. Insoluble in water. Used in dye synthesis, insecticides, fungicides, and in the manufacture of plastics.

Hazards

What is this information?

Reactivity Alerts

none

Air & Water Reactions

Insoluble in water.

Fire Hazard

No information available.

Health Hazard

No information available.

Reactivity Profile

Vigorous reactions, sometimes amounting to explosions, can result from the contact between aromatic hydrocarbons, such as ACENAPHTHYLENE, and strong oxidizing agents. They can react exothermically with bases and with diazo compounds. Substitution at the benzene nucleus occurs by halogenation (acid catalyst), nitration, sulfonation, and the Friedel-Crafts reaction.

Belongs to the Following Reactive Group(s)

- Hydrocarbons, Aromatic

Potentially Incompatible Absorbents

No information available.

Response Recommendations

What is this information? ▶

Isolation and Evacuation

No information available.

Firefighting

This compound is not very flammable but any fire involving this compound may produce dangerous vapors. You should evacuate the area. All firefighters should wear full-body protective clothing and use self-contained breathing apparatuses. You should extinguish any fires involving this chemical with a dry chemical, carbon dioxide, foam, or halon extinguisher. (NTP, 1992)

Non-Fire Response

SMALL SPILLS AND LEAKAGE: You should dampen the solid spill material with acetone, then transfer the dampened material to a suitable container. Use absorbent paper dampened with acetone to pick up any remaining material. Seal your contaminated clothing and the adsorbent paper in a vapor-tight plastic bag for eventual disposal. Solvent wash all contaminated surfaces with acetone followed by washing with a strong soap and water solution. Do not reenter the contaminate area until the Safety Officer (or other responsible person) has verified that the area has been properly cleaned.

STORAGE PRECAUTIONS: You should protect this material from exposure to light, and store it in a refrigerator. (NTP, 1992)

Protective Clothing

RECOMMENDED RESPIRATOR: Where the neat test chemical is weighed and diluted, wear a NIOSH-approved half face respirator equipped with an organic vapor/acid gas cartridge (specific for organic vapors, HCl, acid gas and SO2) with a dust/mist filter.

RECOMMENDED GLOVE MATERIALS: Permeation data indicate that neoprene gloves may provide protection to contact with this compound. Neoprene over latex gloves is recommended. However, if this chemical makes direct contact with your gloves, or if a tear, puncture or hole develops, remove them at once. (NTP, 1992)

DuPont Tychem® Suit Fabrics

No information available.

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. If symptoms such as redness or irritation develop, IMMEDIATELY call a physician and be prepared to transport the victim to a hospital for treatment.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. If symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop, call a physician and be prepared to transport the victim to a hospital. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. Be prepared to transport the victim to a hospital if advised by a physician. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital. (NTP, 1992)

Physical Properties

What is this information?

Chemical Formula: $C_{12}H_8$

Flash Point: data unavailable

Lower Explosive Limit (LEL): data unavailable

Upper Explosive Limit (UEL): data unavailable

Autoignition Temperature: data unavailable

Melting Point: 200.3 to 202.1 ° F (NTP, 1992)

Vapor Pressure: data unavailable

Vapor Density (Relative to Air): data unavailable

Specific Gravity: 0.8988 at 61.0 ° F (NTP, 1992)

Boiling Point: 509 to 527 ° F at 760.0 mm Hg (NTP, 1992)

Molecular Weight: 152.21 (NTP, 1992)

Water Solubility: Insoluble (NTP, 1992)

IDLH: data unavailable

AEGLs (Acute Exposure Guideline Levels)

No AEGL information available.

ERPGs (Emergency Response Planning Guidelines)

No ERPG information available.

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3
Acenaphthylene (208-96-8)	10 mg/m3	110 mg/m3	660 mg/m3

(SCAPA, 2012)

Regulatory Information

What is this information?

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112 (r) RMP TQ
Acenaphthylene	208-96-8			5000			

(EPA List of Lists, 2015)

DHS Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

Alternate Chemical Names

What is this information?

- ACENAPHTHYLENE
- CYCLOPENTA[DE]NAPHTHALENE

About | Privacy Policy | Contact Us | User Survey | Mobile Site

Web site owner: Office of Response and Restoration, NOAA's Ocean Service, National Oceanic and Atmospheric Administration. USA.gov.

CAMEO Chemicals version 2.4.2.

Centers for Disease Control and Prevention
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ACETONE

ICSC: 0087

2-Propanone Dimethyl ketone Methyl ketone C_3H_6O / CH_3COCH_3 Molecular mass: 58.1 ICSC # 0087  3	CAS # 67-64-1 RTECS # AL3150000 UN # 1090 EC # 606-001-00-8 April 22, 1994 Validated Fi, review at IHE: 10/09/89

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, alcohol-resistant foam, water in large amounts, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Sore throat. Cough. Confusion. Headache. Dizziness. Drowsiness. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.

•EYES	Redness. Pain. Blurred vision. Possible corneal damage.	Safety spectacles or face shield . Contact lenses should not be worn.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Nausea. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: self-contained breathing apparatus. Ventilation. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Then wash away with plenty of water.	Fireproof. Separated from strong oxidants. Store in an area without drain or sewer access.	F symbol Xi symbol R: 11-36-66-67 S: 2-9-16-26 UN Hazard Class: 3 UN Packing Group: II

ICSC: 0087	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0087

ACETONE

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR. **PHYSICAL DANGERS:** The vapour is heavier than air and may travel along the ground; distant ignition possible. **CHEMICAL DANGERS:** The substance can form explosive peroxides on contact with strong oxidants such as acetic acid, nitric acid, hydrogen peroxide. Reacts with chloroform and bromoform under basic conditions, causing fire and explosion hazard. Attacks plastic. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 500 ppm as TWA, 750 ppm as STEL; A4 (not classifiable as a human carcinogen); BEI issued; (ACGIH 2004). MAK: 500 ppm 1200 mg/m^3 Peak limitation category: I(2); Pregnancy risk group: D; (DFG 2006). OSHA PEL†: TWA 1000 ppm (2400 mg/m^3) NIOSH REL: TWA 250 ppm (590 mg/m^3) NIOSH IDLH: 2500 ppm 10%LEL See: 67641	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation and through the skin. **INHALATION RISK:** A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster. **EFFECTS OF SHORT-TERM EXPOSURE:** The vapour irritates the eyes and the respiratory tract. The substance may cause effects on the central nervous system , liver , kidneys and gastrointestinal tract . **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the blood and bone marrow .

PHYSICAL PROPERTIES	Boiling point: 56°C Melting point: -95°C Relative density (water = 1): 0.8 Solubility in water: miscible Vapour pressure, kPa at 20°C: 24	Relative vapour density (air = 1): 2.0 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.2 Flash point: -18°C c.c. Auto-ignition temperature: 465°C Explosive limits, vol% in air: 2.2-13 Octanol/water partition coefficient as log Pow: -0.24
ENVIRONMENTAL DATA		

NOTES

Use of alcoholic beverages enhances the harmful effect.

Transport Emergency Card: TEC (R)-30S1090

NFPA Code: H 1; F 3; R 0;

Card has been partially updated in July 2007: see Occupational Exposure Limits.

Card has been partially updated in January 2008: see Storage.

ADDITIONAL INFORMATION

ICSC: 0087 **ACETONE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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ACETOPHENONE

ICSC: 1156

1-Phenylethanone Phenyl methyl ketone Acetylbenzene C_8H_8O / $C_6H_5COCH_3$ Molecular mass: 120.1 ICSC # 1156	CAS # 98-86-2 RTECS # AM5250000 EC # 606-042-00-1 October 24, 1994 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Alcohol-resistant foam, powder, carbon dioxide.
EXPLOSION	Above 82°C explosive vapour/air mixtures may be formed.	Above 82°C use a closed system, ventilation.	
EXPOSURE		PREVENT GENERATION OF MISTS!	
•INHALATION	Headache. Dizziness. Drowsiness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Nausea. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. (Extra personal protection: A/P2 filter respirator for organic vapour and harmful dust).	Separated from strong oxidants. Ventilation along the floor.	Xn symbol R: 22-36 S: 2-26

ICSC: 1156	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1156

ACETOPHENONE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID OR WHITE CRYSTALS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 10 ppm; 49 mg/m^3 (ACGIH 1993-1994).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance irritates the eyes. The substance may cause effects on the central nervous system. Exposure at high level may result in unconsciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin.

PHYSICAL PROPERTIES	Boiling point: 202°C Melting point: 20°C Relative density (water = 1): 1.03 Solubility in water: poor Vapour pressure, kPa at 15°C: 0.133	Relative vapour density (air = 1): 4.1 Relative density of the vapour/air-mixture at 20°C (air = 1): 1 Flash point: 82°C o.c. Auto-ignition temperature: 571°C Octanol/water partition coefficient as log Pow: 1.58
ENVIRONMENTAL DATA		

N O T E S

Use of alcoholic beverages enhances the harmful effect. Hypnone is a trade name.

NFPA Code: H1; F2; R0

ADDITIONAL INFORMATION

ICSC: 1156 **ACETOPHENONE**

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ANTHRACENE

ICSC: 0825

Anthracin Paranaphthalene $C_{14}H_{10}$ / $(C_6H_4CH)_2$ Molecular mass: 178.2 ICSC # 0825	CAS # 120-12-7 RTECS # CA9350000 March 24, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough. Sore throat.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety spectacles, face shield, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain.	Do not eat, drink, or smoke during work.	Rinse mouth. Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place Do NOT let this chemical enter the environment. (Extra personal protection: P2 filter respirator for harmful particles).	Separated from strong oxidants. Well closed.	

ICSC: 0825	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0825

ANTHRACENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE CRYSTALS OR FLAKES.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
The substance decomposes on heating, under influence of strong oxidants producing acrid, toxic fume , causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance slightly irritates the skin and the respiratory tract.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis under the influence of UV light.

PHYSICAL PROPERTIES	Boiling point: 342°C Melting point: 218°C Density: 1.25-1.28 g/cm^3 Solubility in water, g/100 ml at 20 °C: 0.00013 Vapour pressure, Pa at 25°C: 0.08	Relative vapour density (air = 1): 6.15 Flash point: 121°C Auto-ignition temperature: 538°C Explosive limits, vol% in air: 0.6-? Octanol/water partition coefficient as log Pow: 4.5 (calculated)
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.	

NOTES

Green oil, Tetra-olive N2G are trade names.

NFPA Code: H0; F1; R;

ADDITIONAL INFORMATION

ICSC: 0825 **ANTHRACENE**

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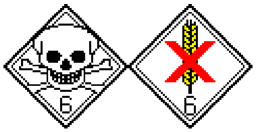
ANTIMONY

ICSC: 0775

Antimony black Antimony regulus Stibium Sb Atomic mass: 121.8 ICSC # 0775 	CAS # 7440-36-0 RTECS # CC4025000 UN # 2871 October 12, 2006 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with oxidants, halogens, acid(s).	water spray, foam, powder, carbon dioxide
EXPLOSION	Finely dispersed particles form explosive mixtures in air. Risk of fire and explosion on contact with .	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough. (See Ingestion).	Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.

•EYES	Redness. Pain.	Safety goggles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Vomiting. Diarrhoea.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention if you feel unwell.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: P2 filter respirator for harmful particles. Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting.	Separated from oxidants , acids, halogens , food and feedstuffs.	Do not transport with food and feedstuffs. UN Hazard Class: 6.1 UN Packing Group: III

ICSC: 0775	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0775

ANTIMONY

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
SILVER-WHITE, LUSTROUS, HARD, BRITTLE LUMPS OR DARK GRAY POWDER

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
On combustion, forms toxic fumes (antimony oxides; see ICSC 0012). Reacts violently with oxidants, , causing fire and explosion hazard. On contact with acids may emit toxic gas (stibine; see ICSC 0776).

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.5 mg/m^3 as TWA (ACGIH 2006).
MAK:
Carcinogen category: 2; Germ cell mutagen group: 3B
(DFG 2006).
OSHA PEL*: TWA 0.5 mg/m^3
*Note: The PEL also applies to other antimony compounds (as Sb).
NIOSH REL*: TWA 0.5 mg/m^3
*Note: The REL also applies to other antimony compounds (as Sb).
NIOSH IDLH: 50 mg/m^3 (as Sb)
See: 7440360

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
May cause mechanical irritation to the eyes.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis, especially when exposed to fumes. The substance may have effects on the lungs , resulting in pneumoconiosis.

PHYSICAL PROPERTIES

Boiling point: 1635 °C
Melting point: 630 °C
Density: 6.7 g/cm^3

Solubility in water: none

ENVIRONMENTAL DATA	

N O T E S

Other boiling points: 1325°C, 1440°C, 1587 °C, 1750°C. The recommendations on this card apply only to metallic antimony. See ICSC 0012 antimony trioxide, ICSC 1224 antimony trichloride, ICSC 0220 antimony pentafluoride and ICSC 0776 antimony trihydride.

Transport Emergency Card: TEC (R)-61GT5-III

ADDITIONAL INFORMATION

ICSC: 0775 **ANTIMONY**

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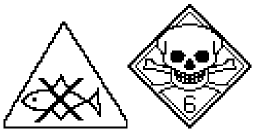
ARSENIC

ICSC: 0013

Grey arsenic As Atomic mass: 74.9 ICSC # 0013 	CAS # 7440-38-2 RTECS # CG0525000 UN # 1558 EC # 033-001-00-X October 18, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with strong oxidizers. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Risk of fire and explosion is slight when exposed to hot surfaces or flames in the form of fine powder or dust.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Sore throat. Shortness of breath. Weakness. See Ingestion.	Closed system and ventilation.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.

•EYES	Redness.	Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Diarrhoea. Nausea. Vomiting. Burning sensation in the throat and chest. Shock or collapse. Unconsciousness.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	Separated from strong oxidants, acids, halogens, food and feedstuffs. Well closed.	Do not transport with food and feedstuffs. Marine pollutant. T symbol N symbol R: 23/25-50/53 S: 1/2-20/21-28-45-60-61 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0013	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0013

ARSENIC

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** ODOURLESS, BRITTLE, GREY, METALLIC-LOOKING CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. Reacts violently with strong oxidants and halogens, causing fire and explosion hazard. Reacts with acids to produce toxic arsine gas (see: ICSC 0222). **OCCUPATIONAL EXPOSURE LIMITS:** OSHA PEL: 1910.1018 TWA 0.010 mg/m^3 NIOSH REL: Ca C 0.002 mg/m^3 15-minute See Appendix A NIOSH IDLH: Ca 5 mg/m^3 (as As) See: 7440382 TLV: 0.01 mg/m^3 as TWA; A1 (confirmed human carcinogen); BEI issued; (ACGIH 2004). MAK: Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly, when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance is irritating to the eyes , the skin and the respiratory tract. The substance may cause effects on the gastrointestinal tract , cardiovascular system , central nervous system and kidneys , resulting in severe gastroenteritis, loss of fluid, and electrolytes, cardiac disorders , shock , convulsions and kidney impairment . Exposure above the OEL may result in death. The effects may be delayed. Medical observation is indicated. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the mucous membranes, skin, peripheral nervous system , liver and bone marrow , resulting in pigmentation disorders, hyperkeratosis, perforation of nasal septum, neuropathy, liver impairment , anaemia . This substance is carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.
PHYSICAL PROPERTIES	Sublimation point: 613°C Density: 5.7 g/cm^3	Solubility in water: none

ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. It is strongly advised that this substance does not enter the environment.

NOTES

The substance is combustible but no flash point is available in literature. Depending on the degree of exposure, periodic medical examination is suggested. Do NOT take working clothes home. Refer also to cards for specific arsenic compounds, e.g., Arsenic pentoxide (ICSC 0377), Arsenic trichloride (ICSC 0221), Arsenic trioxide (ICSC 0378), Arsine (ICSC 0222). Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.Card has been partly updated in October 2005 in section Effects of long-term or repeated exposure.

Transport Emergency Card: TEC (R)-61GT5-II

ADDITIONAL INFORMATION

ICSC: 0013 **ARSENIC**

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Page last reviewed: July 22, 2015

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Right to Know
Hazardous Substance Fact Sheet

Common Name: **ASBESTOS**

Synonyms: See Below

Chemical Name: Asbestos

Date: January 2001 Revision: December 2009

CAS Number: 1332-21-4

RTK Substance Number: 0164

DOT Number: NA 2212

Description and Use

Asbestos is the general term for a group of six naturally occurring, fibrous, *Silicate* minerals. They range in color from white to gray, green, blue or brown and are used in brake linings, heat resistant materials, roofing composites, and in heat and electrical insulations. **Asbestos** has not been manufactured in the United States since 2002.

This fact sheet can also be used for:

ASBESTOS, ACTINOLITE *(RTK # 3170)*	*CAS# 77536-66-4*
ASBESTOS, AMOSITE *(RTK # 0165)*	*CAS# 12172-73-5*
ASBESTOS, ANTHOPHYLLITE *(RTK # 0166)*	*CAS# 77536-67-5*
ASBESTOS, CHRYSOTILE *(RTK # 0167)*	*CAS# 12001-29-5*
ASBESTOS, CROCIDOLITE *(RTK # 0168)*	*CAS# 12001-28-4*
ASBESTOS, TREMOLITE *(RTK # 3283)*	*CAS# 77536-68-6*
TALC (CONTAINING ASBESTOS FIBERS) *(RTK # 4203)*	*CAS# 14807-96-6*

Reasons for Citation

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

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

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

Skin Contact

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

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	-
FLAMMABILITY	0	-
REACTIVITY	0	-
CARCINOGEN DOES NOT BURN		

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

- **Asbestos** can affect you when inhaled.
- **Asbestos** is a CARCINOGEN. HANDLE WITH EXTREME CAUTION.
- Repeated exposure to **Asbestos** can cause the disease called *Asbestosis*, a scarring of the lungs that results in changes on chest x-rays. *Asbestosis* develops some years (from seven to thirty) after the period of exposure. Symptoms include cough, shortness of breath and chest pain. It can progress to disability and death.

Workplace Exposure Limits

The following exposure limits are for fibers longer than **5 micrometers**:

OSHA: The legal airborne permissible exposure limit (PEL) is **0.1 fiber/cc** (fiber per cubic centimeter) averaged over an 8-hour workshift and **1 fiber/cc**, not to be exceeded during any 30-minute work period.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 fiber/cc** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **0.1 fiber/cc** (as the *respirable fraction*) averaged over an 8-hour workshift.

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

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Asbestos**:

- There are no known acute effects. People who develop serious and fatal disease later in life may feel fine at the time of exposure.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Asbestos** and can last for months or years:

Cancer Hazard

- **Asbestos** is a CARCINOGEN in humans. It has been shown to cause cancer of the lung (including mesothelioma) and the gastrointestinal tract.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- While **Asbestos** has been tested, further testing is required to assess its potential to cause reproductive harm.

Other Effects

- Repeated exposure to **Asbestos** can cause the disease called *Asbestosis*, a scarring of the lungs that results in changes on chest x-rays. *Asbestosis* develops some years (from seven to thirty) after the period of exposure. Symptoms include cough, shortness of breath and chest pain. It can progress to disability and death. The earlier exposure is stopped, the better the chance of stopping serious disease later.

Medical

Medical Testing

Before first exposure and every 12 months thereafter, OSHA requires your employer to provide, for persons exposed to **0.1 fiber/cc** (fiber per cubic centimeter) of **Asbestos**, a work and medical history and exam which shall include:

- Chest x-ray and lung function tests
- Any other exams or tests suggested by the examining physician.

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Asbestos* Standard (29 CFR 1910.1001).

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

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

Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.

Workplace Controls and Practices

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

The following work practices are also recommended:

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

In addition, the following may be useful or required:

- Specific actions are required for this chemical by OSHA. Refer to the OSHA *Asbestos* Standard (29 CFR 1910.1001).
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP and NEVER USE COMPRESSED AIR.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Asbestos**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Natural Rubber for gloves, and Tyvek®, or the equivalent, as a protective clothing material.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.

Respiratory Protection

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

- DO NOT USE DISPOSABLE RESPIRATORS FOR **Asbestos**.
- Where the potential exists for exposure over **0.1 fiber/cc**, use a NIOSH approved negative pressure, air-purifying, particulate filter respirator with an N, R or P100 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- A powered-air purifying respirator (PAPR) with a high efficiency filter must be provided instead of a negative pressure respirator when the employee chooses it and when the respirator (PAPR) provides adequate protection.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Asbestos**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **1 fiber/cc**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

Fire Hazards

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

- Extinguish fire using an agent suitable for type of surrounding fire. **Asbestos** itself does not burn.

Spills and Emergencies

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

If **Asbestos** is spilled, take the following steps:

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

Handling and Storage

Prior to working with **Asbestos** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Asbestos** is handled, used or stored as required by the OSHA *Asbestos* Standard (29 CFR 1910.1001).
- Airborne **Asbestos** dust is very difficult to remove. It is essential that any area where **Asbestos** is handled be enclosed and isolated. The material should be kept wet with special surfactants and water.
- Enclose operations and use local exhaust ventilation with negative pressure air filtration and high efficiency particulate filters in the area of **Asbestos** removal. If enclosure with containment "glove" boxes is not used for minor repairs, respirators must be worn and proper procedures must be followed.
- All **Asbestos** materials must be removed and disposed of according to regulations. The area must be monitored to ensure airborne **Asbestos** levels are below limits prior to reoccupation of the area where **Asbestos** was disturbed.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **ASBESTOS**

Synonyms: Actinolite; Amosite; Anthophyllite; Chrysotile; Crocidolite; Tremolite
CAS No: 1332-21-4
Molecular Formula: Varies
RTK Substance No: 0164
Description: Group of six naturally occurring, fibrous *Silicate* minerals that range in color from white to gray, green blue or brown

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **0 - Fire** **0 - Reactivity** **DOT#:** NA 2212 **ERG Guide #:** 171 **Hazard Class:** 9 (Miscellaneous Hazardous Substance)	Extinguish fire using an agent suitable for type of surrounding fire. **Asbestos** itself does not burn.	Not reactive

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.
DO NOT USE COMPRESSED AIR.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Noncombustible
Vapor Pressure:	0 mm Hg at 8°F (20°C) (approx.)
Water Solubility:	Insoluble
Boiling Point:	Decomposes
Melting Point:	1,112°F (600°C)
Molecular Weight:	277 (for *Chrysotile Asbestos*)

EXPOSURE LIMITS

OSHA:	0.1 f/cc, 8-hr TWA; 1 f/cc, 30 min. Ceiling
NIOSH:	0.1 f/cc, 10-hr TWA
ACGIH:	0.1 f/cc, 8-hr TWA

The Protective Action Criteria values are:
PAC-1 = 0.05 mg/m^3
PAC-2 = 0.06 mg/m^3
PAC-3 = 0.3 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Natural Rubber
Coveralls:	Tyvek®
Respirator:	>0.1 f/cc - full facepiece APR with *High efficiency filter* >1 f/cc (0.05 mg/m^3) - SCBA

HEALTH EFFECTS

Eyes:	No acute health effects known
Skin:	No acute health effects known
Inhalation:	No acute health effects known
Chronic:	Cancer (lung and gastrointestinal tract) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
Remove contaminated clothing and wash contaminated skin with soap and water.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.

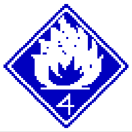
December 2009

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries
NIOSH®

BARIUM

ICSC: 1052

Ba Atomic mass: 137.3 ICSC # 1052 	CAS # 7440-39-3 RTECS # CQ8370000 UN # 1400 October 20, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable. Many reactions may cause fire or explosion.	NO open flames, NO sparks, and NO smoking. NO contact with water.	Special powder, dry sand, NO hydrous agents, NO water.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
•INHALATION	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower. Refer for medical attention.
•EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers. Carefully collect remainder, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT wash away into sewer.	Separated from halogenated solvents, strong oxidants, acids. Dry. Keep under inert gas, oil or oxygen-free liquid.	UN Hazard Class: 4.3 UN Packing Group: II

ICSC: 1052	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1052

BARIUM

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOWISH TO WHITE LUSTROUS SOLID IN VARIOUS FORMS. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** The substance may spontaneously ignite on contact with air (if in powder form). The substance is a strong reducing agent and reacts violently with oxidants and acids. Reacts violently with halogenated solvents. Reacts with water, forming flammable/explosive gas (hydrogen - see ICSC0001), causing fire and explosion hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: 0.5 mg/m^3 as TWA A4 (not classifiable as a human carcinogen); (ACGIH 2008). EU OEL: 0.5 mg/m^3 as TWA (EU 2006).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by ingestion. **INHALATION RISK:** **EFFECTS OF SHORT-TERM EXPOSURE:** The substance irritates the eyes, the skin and the respiratory tract. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 1640°C Melting point: 725°C Density: 3.6 g/cm^3	Solubility in water: reaction

ENVIRONMENTAL DATA	

N O T E S

Reacts violently with fire extinguishing agents such as water, bicarbonate, powder, foam, and carbon dioxide. Rinse contaminated clothes (fire hazard) with plenty of water.

Transport Emergency Card: TEC (R)-43G12

Card has been partially updated in November 2008: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 1052 **BARIUM**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

BENZ(a)ANTHRACENE

ICSC: 0385

1,2-Benzoanthracene Benzo(a)anthracene 2,3-Benzphenanthrene Naphthanthracene $C_{18}H_{12}$ Molecular mass: 228.3 ICSC # 0385	CAS # 56-55-3 RTECS # CV9275000 EC # 601-033-00-9 October 23, 1995 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.		Water spray, powder. In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety goggles , face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: complete protective clothing including self-contained breathing apparatus.	Well closed.	T symbol N symbol R: 45-50/53 S: 53-45-60-61

ICSC: 0385	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0385

BENZ(a)ANTHRACENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO YELLOW - BROWN FLUORESCENT FLAKES OR POWDER. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS:** TLV: A2 (suspected human carcinogen); (ACGIH 2004). MAK: Carcinogen category: 2 (as pyrolysis product of organic materials) (DFG 2005).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation, through the skin and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Sublimation point: 435°C Melting point: 162°C Relative density (water = 1): 1.274 Solubility in water: none	Vapour pressure, Pa at 20°C: 292 Octanol/water partition coefficient as log Pow: 5.61

ENVIRONMENTAL DATA	Bioaccumulation of this chemical may occur in seafood.

N O T E S

This substance is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Tetraphene is a common name. Card has been partly updated in October 2005 and August 2006: see sections Occupational Exposure Limits, EU classification.

ADDITIONAL INFORMATION

ICSC: 0385 **BENZ(a)ANTHRACENE**

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Page last reviewed: July 22, 2015

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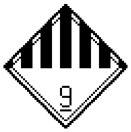
Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

BENZALDEHYDE

ICSC: 0102

Benzoic aldehyde Artificial almond oil Benzenecarbonal C_7H_6O / C_6H_5CHO Molecular mass: 106.1 ICSC # 0102  	CAS # 100-52-7 RTECS # CU4375000 UN # 1990 EC # 605-012-00-5 April 05, 2006 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Water spray, foam, powder, carbon dioxide.
EXPLOSION	Above 63°C explosive vapour/air mixtures may be formed.	Above 63°C use a closed system, ventilation.	
EXPOSURE			
•INHALATION	Cough. Sore throat.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest.
•SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness. Pain.	Safety spectacles or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Sore throat.	Do not eat, drink, or smoke during work.	Rinse mouth. Rest.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: filter respirator for organic gases and vapours. Collect leaking liquid in sealable containers. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment.	Separated from incompatible materials (See Chemical Dangers). Well closed. Ventilation along the floor. Store in an area without drain or sewer access. Cool. Keep in the dark.	Xn symbol R: 22 S: 2-24 UN Hazard Class: 9 UN Packing Group: III Signal: Warning Flame-Excl mark Flammable liquid and vapour Harmful if swallowed Harmful in contact with skin Toxic to aquatic life

ICSC: 0102	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0102

BENZALDEHYDE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance can form explosive peroxides under special conditions. Reacts violently with aluminium, bases, iron, oxidants and phenol causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV not established.
MAK: IIb (not established but data is available) (DFG 2005).

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its vapour, through the skin and by ingestion.

INHALATION RISK:
No indication can be given about the rate in which a harmful concentration in the air is reached on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

PHYSICAL PROPERTIES	Boiling point: 179°C Melting point: -26°C Relative density (water = 1): 1.05 Solubility in water, g/100 ml: (poor) at 25°C Vapour pressure, Pa at 26°C: 133	Relative vapour density (air = 1): 3.7 Flash point: 63°C c.c. Auto-ignition temperature: 192°C Explosive limits, vol% in air: 1.4 Octanol/water partition coefficient as log Pow: 1.48
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms.	

NOTES

Rinse contaminated clothes with plenty of water because of fire hazard. Check for peroxides prior to distillation; eliminate if found.

Transport Emergency Card: TEC (R)-90S1990
NFPA Code: H2; F2; R0

ADDITIONAL INFORMATION

ICSC: 0102 **BENZALDEHYDE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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BENZO(a)PYRENE

ICSC: 0104

Benz(a)pyrene 3,4-Benzopyrene Benzo(d,e,f)chrysene $C_{20}H_{12}$ Molecular mass: 252.3 ICSC # 0104	CAS # 50-32-8 RTECS # DJ3675000 EC # 601-032-00-3 October 17, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, foam, powder, carbon dioxide.
EXPLOSION			
EXPOSURE	See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.	AVOID ALL CONTACT! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT let this chemical enter the environment. Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Separated from strong oxidants.	T symbol N symbol R: 45-46-60-61-43-50/53 S: 53-45-60-61

ICSC: 0104	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0104

BENZO(a)PYRENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** PALE-YELLOW CRYSTALS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Reacts with strong oxidants causing fire and explosion hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: Exposure by all routes should be carefully controlled to levels as low as possible A2 (suspected human carcinogen); (ACGIH 2005). MAK: Carcinogen category: 2; Germ cell mutagen group: 2; (DFG 2005).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is carcinogenic to humans. May cause heritable genetic damage to human germ cells. Animal tests show that this substance possibly causes toxicity to human reproduction or development.
PHYSICAL PROPERTIES	Boiling point: 496°C Melting point: 178.1°C Density: 1.4 g/cm^3	Solubility in water: none (<0.1 g/100 ml) Vapour pressure : negligible Octanol/water partition coefficient as log Pow: 6.04

ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish, in plants and in molluscs. The substance may cause long-term effects in the aquatic environment.

NOTES

Do NOT take working clothes home. Benzo(a)pyrene is present as a component of polycyclic aromatic hydrocarbons (PAHs) in the environment, usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.

ADDITIONAL INFORMATION

ICSC: 0104 **BENZO(a)PYRENE**

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BENZO(b)FLUORANTHENE

ICSC: 0720

Benz(e)acephenanthrylene 2,3-Benzofluoroanthene Benzo(e)fluoranthene 3,4-Benzofluoranthene $C_{20}H_{12}$ Molecular mass: 252.3 ICSC # 0720	CAS # 205-99-2 RTECS # CU1400000 EC # 601-034-00-4 March 25, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Well closed.	T symbol N symbol R: 45-50/53 S: 53-45-60-61

ICSC: 0720	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0720

BENZO(b)FLUORANTHENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS CRYSTALS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: A2 (suspected human carcinogen); (ACGIH 2004). MAK: Carcinogen category: 2; (DFG 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans. May cause genetic damage in humans.
PHYSICAL PROPERTIES	Boiling point: 481°C Melting point: 168°C Solubility in water: none	Octanol/water partition coefficient as log Pow: 6.12

ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air quality and water quality.

N O T E S

Benzo(b)fluoranthene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.ACGIH recommends environment containing benzo(b)fluoranthene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0720 **BENZO(b)FLUORANTHENE**

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BENZO(ghi)PERYLENE

ICSC: 0739

1,12-Benzoperylene 1,12-Benzperylene $C_{22}H_{12}$ Molecular mass: 276.3 ICSC # 0739	CAS # 191-24-2 RTECS # DI6200500 October 18, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions.	NO open flames.	In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into covered containers. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Well closed.	

ICSC: 0739	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0739

BENZO(ghi)PERYLENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** PALE YELLOW-GREEN CRYSTALS. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 550°C Melting point: 278°C Density: 1.3 g/cm^3	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.58

ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air and water.

NOTES

Benzo(ghi)perylene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco. Data are insufficiently available on the effect of this substance on human health, therefore utmost care must be taken.

ADDITIONAL INFORMATION

ICSC: 0739 **BENZO(ghi)PERYLENE**

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BENZO(k)FLUORANTHENE

ICSC: 0721

Dibenzo(b,jk)fluorene 8,9-Benzofluoranthene 11,12-Benzofluoranthene $C_{20}H_{12}$ Molecular mass: 252.3 ICSC # 0721	CAS # 207-08-9 RTECS # DF6350000 EC # 601-036-00-5 March 25, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Well closed.	T symbol N symbol R: 45-50/53 S: 53-45-60-61
ICSC: 0721	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

ICSC: 0721

BENZO(k)FLUORANTHENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established. MAK: Carcinogen category: 2; (DFG 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 480°C Melting point: 217°C Solubility in water: none	Octanol/water partition coefficient as log Pow: 6.84

ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air quality and water quality. Bioaccumulation of this chemical may occur in crustacea and in fish.

NOTES

Benzo(k)fluoranthene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.ACGIH recommends environment containing benzo(k)fluoranthene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0721 **BENZO(k)FLUORANTHENE**

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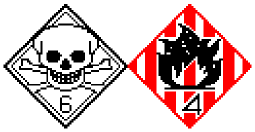
BERYLLIUM

ICSC: 0226

Glucinium Be Atomic mass: 9.0 ICSC # 0226 	CAS # 7440-41-7 RTECS # DS1750000 UN # 1567 EC # 004-001-00-7 October 20, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Special powder, dry sand, NO other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Shortness of breath. Sore throat. Weakness. Symptoms may be delayed (see Notes).	Local exhaust. Breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Carefully collect the spilled substance into containers; if appropriate moisten first, then remove to safe place. Chemical protection suit including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	Separated from strong acids, bases , chlorinated solvents, food and feedstuffs . Store in an area without drain or sewer access.	Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Note: E T+ symbol R: 49-25-26-36/37/38-43-48/23 S: 53-45 UN Hazard Class: 6.1 UN Subsidiary Risks: 4.1 UN Packing Group: II

ICSC: 0226	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0226

BERYLLIUM

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
GREY TO WHITE POWDER.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
Reacts with strong acids and strong bases forming flammable/explosive gas (hydrogen - see ICSC0001) . Forms shock sensitive mixtures with some chlorinated solvents, such as carbon tetrachloride and trichloroethylene.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.002 mg/m^3 as TWA, 0.01 mg/m^3 as STEL; A1 (confirmed human carcinogen); (ACGIH 2004). Intended change 0.00002 mg/m^3
Skin, Inhal.
SEN (ACGIH 2005).
MAK: sensitization of respiratory tract and skin (Sah);
Carcinogen category: 1;
(DFG 2004).
OSHA PEL: TWA 0.002 mg/m^3 C 0.005 mg/m^3 0.025 mg/m^3 30-minute maximum peak
NIOSH REL: Ca Not to exceed 0.0005 mg/m^3 See Appendix A
NIOSH IDLH: Ca 4 mg/m^3 (as Be)
See: IDLH INDEX

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The aerosol of this substance is irritating to the respiratory tract . Inhalation of dust or fumes may cause chemical pneumonitis. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact may cause skin sensitization. Lungs may be affected by repeated or prolonged exposure to dust particles , resulting in chronic beryllium disease (cough, weight loss, weakness). This substance is carcinogenic to humans.

PHYSICAL PROPERTIES

Boiling point: above 2500°C
Melting point: 1287°C
Density: 1.9 g/cm^3

Solubility in water: none

ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. Do NOT take working clothes home. Card has been partly updated in October 2005. See sections Occupational Exposure Limits, Emergency Response.

Transport Emergency Card: TEC (R)-61GTF3-II

NFPA Code: H3; F1; R0
Card has been partially updated in January 2008: see Storage.

ADDITIONAL INFORMATION

ICSC: 0226 **BERYLLIUM**

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Right to Know
Hazardous Substance Fact Sheet

Common Name: **BIS(2-ETHYLHEXYL) PHTHALATE**

Synonyms: Di(2-Ethylhexyl) Phthalate; Dioctyl Phthalate; DOP

Chemical Name: 1,2-Benzenedicarboxylic Acid, Bis(2-Ethylhexyl) Ester

Date: July 1998 Revision: February 2008

CAS Number:	117-81-7
RTK Substance Number:	0238
DOT Number:	None

Description and Use

Bis(2-Ethylhexyl) Phthalate is a colorless to light colored, thick liquid with a slight odor. It is used as a plasticizer for resins, in pesticides, and as a solvent for ink.

Reasons for Citation

- **Bis(2-Ethylhexyl) Phthalate** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, NIOSH, NTP, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

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

Skin Contact
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-
CARCINOGEN TERATOGEN COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **Bis(2-Ethylhexyl) Phthalate** can affect you when inhaled.
- **Bis(2-Ethylhexyl) Phthalate** should be handled as a CARCINOGEN and TERATOGEN--WITH EXTREME CAUTION.
- **Bis(2-Ethylhexyl) Phthalate** may damage the testes (male reproductive glands) and may decrease fertility in males and females.
- Contact can irritate the skin and eyes.
- Inhaling **Bis(2-Ethylhexyl) Phthalate** can irritate the nose and throat.
- **Bis(2-Ethylhexyl) Phthalate** may affect the nervous system and the liver.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **5 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **5 mg/m^3** averaged over a 10-hour workshift and **10 mg/m^3**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **5 mg/m^3** averaged over an 8-hour workshift.

- **Bis(2-Ethylhexyl) Phthalate** is a PROBABLE CARCINOGEN and TERATOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Bis(2-Ethylhexyl) Phthalate**:

- Contact can irritate the skin and eyes.
- Inhaling **Bis(2-Ethylhexyl) Phthalate** can irritate the nose and throat.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Bis(2-Ethylhexyl) Phthalate** and can last for months or years:

Cancer Hazard

- **Bis(2-Ethylhexyl) Phthalate** may be a CARCINOGEN in humans since it has been shown to cause liver cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- **Bis(2-Ethylhexyl) Phthalate** may be a TERATOGEN in humans since it is a teratogen in animals.
- **Bis(2-Ethylhexyl) Phthalate** may damage the testes (male reproductive glands).
- **Bis(2-Ethylhexyl) Phthalate** may decrease fertility in males and females.

Other Effects

- **Bis(2-Ethylhexyl) Phthalate** may affect the nervous system and the liver.

Medical

Medical Testing
If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Liver function tests

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

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

Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Bis(2-Ethylhexyl) Phthalate**.

Workplace Controls and Practices

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

The following work practices are also recommended:

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

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Bis(2-Ethylhexyl) Phthalate**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend *Neoprene* and *Laminate Film* for gloves and DuPont *Tychem® BR*, LV, *TK*, *CSM*, and *Responder®*, or equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

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

- Where the potential exists for exposure over **5 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **5,000 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5,000 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

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

- **Bis(2-Ethylhexyl) Phthalate** is a COMBUSTIBLE LIQUID.
- Use dry chemical, CO_2, water spray, alcohol-resistant foam or other foam as extinguishing agents.
- Water or foam may cause frothing.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

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

If **Bis(2-Ethylhexyl) Phthalate** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Bis(2-Ethylhexyl) Phthalate** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Bis(2-Ethylhexyl) Phthalate** you should be trained on its proper handling and storage.

- **Bis(2-Ethylhexyl) Phthalate** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).
- Store in tightly closed containers in a cool, well-ventilated area away from HEAT.
- Sources of ignition, such as smoking and open flames, are prohibited where **Bis(2-Ethylhexyl) Phthalate** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

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

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

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

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

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

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

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

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **BIS(2-ETHYLHEXYL) PHTHALATE**

Synonyms: Di(2-Ethylhexyl) Phthalate; Dioctyl Phthalate; DOP
CAS No: 117-81-7
Molecular Formula: $C_{24}H_{38}O_4$
RTK Substance No: 0238
Description: Colorless to light colored, thick liquid with a slight odor

HAZARD DATA

Hazard Rating

3 - Health

1 - Fire

0 - Reactivity

DOT#: None

ERG Guide #: None

Hazard Class: None

Firefighting

COMBUSTIBLE LIQUID.

Use dry chemical, CO_2, water spray, alcohol-resistant foam or other foam as extinguishing agents.

Water or foam may cause frothing.

POISONOUS GASES ARE PRODUCED IN FIRE.

Use water spray to keep fire-exposed containers cool.

Reactivity

Bis(2-Ethylhexyl) Phthalate is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).

SPILL/LEAKS

Isolation Distance:

Small Spills: 60 meters (200 feet)

Large Spills: 330 meters (1,100 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.

Bioaccumulation of this chemical may occur in seafood.

PHYSICAL PROPERTIES

Flash Point:	420°F (215°C)
LEL:	0.3% at 474°F (245°C)
Auto Ignition Temp:	662°F (350°C)
Vapor Density:	16 (air = 1)
Vapor Pressure:	<1 mm Hg at 68°F (20°C)
Specific Gravity:	0.99 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	725°F (385°C)
Melting Point:	-58°F (-50°C)
Molecular Weight:	391

EXPOSURE LIMITS

OSHA:	5 mg/m^3, 8-hr TWA
NIOSH:	5 mg/m^3, 10-hr TWA; 10 mg/m^3, STEL
ACGIH:	5 mg/m^3, 8-hr TWA
IDLH LEVEL:	5,000 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Neoprene and Laminate Film
Coveralls:	DuPont Tychem® BR, LV, TK, CSM and Responder® (>8-hr breakthrough)
Respirator:	>5 mg/m^3 - Supplied air

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose and throat irritation
Chronic:	Cancer (liver) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

Quickly remove contaminated clothing. Wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer to a medical facility.

February 2008

Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

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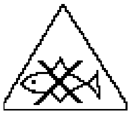
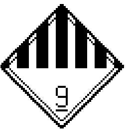
to Prevent Workplace Illnesses and Injuries

BUTYL BENZYL PHTHALATE

ICSC: 0834

Benzyl butyl phthalate 1,2-Benzenedicarboxylic acid, butyl phenylmethyl ester BBP $1,_2C_6H_4(COOCH_2C_6H_5)(COOC_4H_9)$ / $C_{19}H_{20}O_4$ Molecular mass: 312.4 ICSC # 0834 	CAS # 85-68-7 RTECS # TH9990000 UN # 3082 EC # 607-430-00-3 October 20, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Alcohol-resistant foam. Powder, carbon dioxide. Water spray .
EXPLOSION			
EXPOSURE	See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.	PREVENT GENERATION OF MISTS! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION		Ventilation, local exhaust, or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles .	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place.	Store in an area without drain or sewer access. Separated from strong oxidants.	Marine pollutant. T symbol N symbol R: 61-62-50/53 S: 45-53-60-61 UN Hazard Class: 9 UN Packing Group: III

ICSC: 0834	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0834

BUTYL BENZYL PHTHALATE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS OILY LIQUID

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on burning producing toxic fumes . Reacts with oxidants.

OCCUPATIONAL EXPOSURE LIMITS:
TLV not established.
MAK not established.

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its aerosol and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly on spraying.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES	Boiling point: 370°C Melting point: -35°C Relative density (water = 1): 1.1 Solubility in water: 0.71 mg/l (very poor) Vapour pressure, Pa at 20°C: negligible	Relative vapour density (air = 1): 10.8 Flash point: 198°C Auto-ignition temperature: 425°C Octanol/water partition coefficient as log Pow: 4.77
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish.	

NOTES

Saniticizer 160, Sicol 160, Unimoll BB and Palatinol BB are trade names.

Transport Emergency Card: TEC (R)-90GM6-III

NFPA Code: H1; F1; R0;

ADDITIONAL INFORMATION

ICSC: 0834 **BUTYL BENZYL PHTHALATE**

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Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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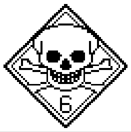
CADMIUM

ICSC: 0020

Cd Atomic mass: 112.4 ICSC # 0020  	CAS # 7440-43-9 RTECS # EU9800000 UN # 2570 EC # 048-002-00-0 April 22, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable in powder form and spontaneously combustible in pyrophoric form. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with heat or acid(s).	Dry sand. Special powder. NO other agents.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.

•EYES	Redness. Pain.	Safety goggles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Diarrhoea. Headache. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Personal protection: chemical protection suit including self-contained breathing apparatus. Remove all ignition sources. Sweep spilled substance into containers. Carefully collect remainder, then remove to safe place.	Fireproof. Dry. Keep under inert gas. Separated from igntion sources, oxidants acids, food and feedstuffs .	Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. Note: E T+ symbol N symbol R: 45-26-48/23/25-62-63-68-50/53 S: 53-45-60-61 UN Hazard Class: 6.1

ICSC: 0020	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0020

CADMIUM

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** SOFT BLUE-WHITE METAL LUMPS OR GREY POWDER. MALLEABLE. TURNS BRITTLE ON EXPOSURE TO 80°C AND TARNISHES ON EXPOSURE TO MOIST AIR. **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** Reacts with acids forming flammable/explosive gas (hydrogen - see ICSC0001). Dust reacts with oxidants, hydrogen azide, zinc, selenium or tellurium , causing fire and explosion hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: (Total dust) 0.01 mg/m^3; (Respirable fraction) 0.002 mg/m^3; as TWA; A2 (suspected human carcinogen); BEI issued; (ACGIH 2005). MAK: skin absorption (H); Carcinogen category: 1; Germ cell mutagen group: 3A; (DFG 2004). OSHA PEL*: 1910.1027 TWA 0.005 mg/m^3 *Note: The PEL applies to all Cadmium compounds (as Cd). NIOSH REL*: Ca See Appendix A *Note: The REL applies to all Cadmium compounds (as Cd). NIOSH IDLH: Ca 9 mg/m^3 (as Cd) See: IDLH INDEX	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and by ingestion. **INHALATION RISK:** A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered. **EFFECTS OF SHORT-TERM EXPOSURE:** The fume is irritating to the respiratory tract . Inhalation of fume may cause lung oedema (see Notes). Inhalation of fumes may cause metal fume fever. The effects may be delayed. Medical observation is indicated. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Lungs may be affected by repeated or prolonged exposure to dust particles. The substance may have effects on the kidneys , resulting in kidney impairment . This substance is carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 765°C Melting point: 321°C Density: 8.6 g/cm^3	Solubility in water: none Auto-ignition temperature: (cadmium metal dust) 250°C

ENVIRONMENTAL DATA	

N O T E S

Reacts violently with fire extinguishing agents such as water,foam,carbon dioxideand halons. Depending on the degree of exposure, periodic medical examination is indicated. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Do NOT take working clothes home. Cadmium also exists in a pyrophoric form (EC No. 048-011-00-X), which bears the additional EU labelling symbol F, R phrase 17, and S phrases 7/8 and 43. UN numbers and packing group will vary according to the physical form of the substance.

ADDITIONAL INFORMATION

ICSC: 0020 **CADMIUM**

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Page last reviewed: July 22, 2015

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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CAPROLACTAM

ICSC: 0118

Hexahydro-2H-azepin-2-one Aminocaproic lactam epsilon-Caprolactam $C_6H_{11}NO$ Molecular mass: 113.2 ICSC # 0118	CAS # 105-60-2 RTECS # CM3675000 EC # 613-069-00-2 April 22, 1994 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Foam, powder, carbon dioxide, water in large amounts .
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	
•INHALATION	Abdominal cramps. Confusion. Cough. Dizziness. Headache.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness. Pain.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION	Abdominal pain. Diarrhoea. Nausea. Vomiting. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Let solidify if molten. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Wash away remainder with plenty of water. Personal protection: P2 filter respirator for harmful particles.	Separated from strong oxidants. Dry.	Xn symbol R: 20/22-36/37/38 S: (2)

ICSC: 0118	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0118

CAPROLACTAM

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE, HYGROSCOPIC FLAKES OR CRYSTALS.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on heating and on burning producing toxic fumes including nitrogen oxides , ammonia . Reacts violently with strong oxidants producing toxic fumes.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 5 mg/m^3 as TWA; A5 (not suspected as a human carcinogen); (ACGIH 2004).
MAK: (Inhalable fraction) 5 mg/m^3;
Peak limitation category: I(2);
Pregnancy risk group: C;
(DFG 2004).
OSHA PEL†: none
NIOSH REL: Dust: TWA 1 mg/m^3 ST 3 mg/m^3 Vapor: TWA 0.22 ppm (1 mg/m^3) ST 0.66 ppm (3 mg/m^3)
NIOSH IDLH: N.D. See: IDLH INDEX

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its vapour or dust.

INHALATION RISK:
A harmful contamination of the air will not or will only very slowly be reached on evaporation of this substance at 20°C ; on spraying or dispersing, however, much faster.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the skin . The vapour is irritating to the eyes and the respiratory tract . Inhalation of the vapour may cause effects on the central nervous system.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. Repeated or prolonged contact may cause skin sensitization. The substance may have effects on the nervous system liver .

PHYSICAL PROPERTIES	Boiling point: 267°C Melting point: 70°C Relative density (water = 1): 1.02 Solubility in water: good Vapour pressure, Pa at 25°C: 0.26	Relative vapour density (air = 1): 3.91 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.0 Flash point: 125°C o.c. Auto-ignition temperature: 375°C Explosive limits, vol% in air: 1.4-8 Octanol/water partition coefficient as log Pow: -0.19
ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to aquatic organisms.	

NOTES

The substance is usually used, stored and transported in liquefied form at about 80°C. Card has been partly updated in April 2005. See section Occupational Exposure Limits.

NFPA Code: H 1; F 1; R 0;

ADDITIONAL INFORMATION

ICSC: 0118 **CAPROLACTAM**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

SAFETY DATA SHEET

Creation Date 14-May-2010 **Revision Date** 23-Dec-2014 **Revision Number** 1

1. Identification

Product Name	**Carbazole**
Cat No. :	**AC108260000; AC108260010; AC108260050; AC108260250; AC108262500; AC108265000**
Synonyms	9-Azafluorene; Dibenzopyrrole; Diphenylenimine
Recommended Use	Laboratory chemicals.
Uses advised against	No Information available

Details of the supplier of the safety data sheet

Emergency Telephone Number

CHEMTREC Tel. No.**US:**001-800-424-9300 /
Europe:001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Skin Corrosion/irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Carcinogenicity	Category 1B
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Danger

Hazard Statements
Causes skin irritation
Causes serious eye irritation
May cause respiratory irritation
May cause cancer

Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component	CAS-No	Weight %
9H-Carbazole	86-74-8	>95

4. First-aid measures

Eye Contact	Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Obtain medical attention.
Skin Contact	Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Obtain medical attention.
Inhalation	Remove from exposure, lie down. Move to fresh air. Obtain medical attention.
Ingestion	Clean mouth with water. Get medical attention.
Most important symptoms/effects	No information available.
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Water spray. Carbon dioxide (CO_2). Dry chemical. chemical foam.
Unsuitable Extinguishing Media	No information available
Flash Point	220 °C / 428 °F
Method -	No information available
Autoignition Temperature	540 °C / 1004 °F
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Do not allow run-off from fire fighting to enter drains or water courses.

Hazardous Combustion Products

Nitrogen oxides (NOx) Carbon monoxide (CO) Carbon dioxide (CO_2)

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	0	N/A

6. Accidental release measures

Personal Precautions	Ensure adequate ventilation. Use personal protective equipment.
Environmental Precautions	Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.
Methods for Containment and Clean Up	Sweep up or vacuum up spillage and collect in suitable container for disposal. Do not let this chemical enter the environment.

7. Handling and storage

Handling	Avoid contact with skin and eyes. Do not breathe dust. Do not ingest. Use only in area provided with appropriate exhaust ventilation.
Storage	Keep in a dry, cool and well-ventilated place. Keep container tightly closed.

8. Exposure controls / personal protection

Exposure Guidelines	This product does not contain any hazardous materials with occupational exposure limits established by the region specific regulatory bodies.
Engineering Measures	Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.
Personal Protective Equipment	
Eye/face Protection	Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.
Skin and body protection	Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Beige
Odor	pungent
Odor Threshold	No information available
pH	No information available
Melting Point/Range	240 - 246 °C / 464 - 474.8 °F
Boiling Point/Range	355 °C / 671 °F @ 760 mmHg
Flash Point	220 °C / 428 °F
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	400 mmHg @ 323 °C
Vapor Density	Not applicable
Relative Density	1.1
Solubility	insoluble
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	540 °C / 1004 °F
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	$C_{12}H_9N$
Molecular Weight	167.21

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products.
Incompatible Materials	Strong oxidizing agents, Strong bases
Hazardous Decomposition Products	Nitrogen oxides (NOx), Carbon monoxide (CO), Carbon dioxide (CO_2)
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
9H-Carbazole	>5000 mg/kg (Rat)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	No information available
Sensitization	No information available
Carcinogenicity	The table below indicates whether each agency has listed any ingredient as a carcinogen. Limited evidence of a carcinogenic effect.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
9H-Carbazole	86-74-8	Group 2B	Not listed	Not listed	X	Not listed

Mutagenic Effects	Not mutagenic in AMES Test
Reproductive Effects	No information available.
Developmental Effects	No information available.
Teratogenicity	No information available.
STOT - single exposure	Respiratory system
STOT - repeated exposure	None known
Aspiration hazard	No information available
Symptoms / effects,both acute and delayed	No information available
Endocrine Disruptor Information	No information available
Other Adverse Effects	The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
9H-Carbazole	6.7 mg/L EC50 = 60 h	1 mg/L LC50 48 h	EC50 = 10.6 mg/L 15 min EC50 = 11.6 mg/L 30 min EC50 = 13.6 mg/L 5 min	Not listed

Persistence and Degradability	Insoluble in water Persistence is unlikely
Bioaccumulation/ Accumulation	No information available.
Mobility	. Is not likely mobile in the environment due its low water solubility.

Component	log Pow
9H-Carbazole	3.84

13. Disposal considerations

Waste Disposal Methods	Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s.
Proper technical name	9H-Carbazole
Hazard Class	9
Packing Group	III

TDG

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s.
Hazard Class	9
Packing Group	III

IATA

UN-No	UN3077
Proper Shipping Name	Environmentally hazardous substance, solid, n.o.s.
Hazard Class	9
Packing Group	III

IMDG/IMO

UN-No	UN3077
Proper Shipping Name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Hazard Class	9
Packing Group	III

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
9H-Carbazole	X	X	-	201-696-0	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b)	Not applicable
SARA 313	Not applicable

SARA 311/312 Hazardous Categorization

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

Clean Water Act	Not applicable
Clean Air Act	Not applicable

OSHA Occupational Safety and Health Administration
Not applicable

CERCLA
Not applicable

California Proposition 65 This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category

9H-Carbazole	86-74-8	Carcinogen	4.1 µg/day	Carcinogen

State Right-to-Know Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ):	N
DOT Marine Pollutant	N
DOT Severe Marine Pollutant	N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class D2A Very toxic materials

16. Other information

Prepared By

Creation Date	14-May-2010
Revision Date	23-Dec-2014
Print Date	23-Dec-2014
Revision Summary	This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer
The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS

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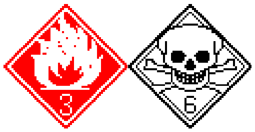
CARBON DISULFIDE

ICSC: 0022

Carbon disulphide
Carbon bisulfide
Carbon sulfide
CS_2
Molecular mass: 76.1
ICSC # 0022



CAS # 75-15-0
RTECS # FF6650000
UN # 1131
EC # 006-003-00-3
April 10, 2000 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable. Many reactions may cause fire or explosion. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking. NO contact with hot surfaces.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Prevent build-up of electrostatic charges (e.g., by grounding). Do NOT use compressed air for filling, discharging, or handling. Do NOT expose to friction or shock.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!	IN ALL CASES CONSULT A DOCTOR!

•INHALATION	Dizziness. Headache. Nausea. Shortness of breath. Vomiting. Weakness. Irritability. Hallucination.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	MAY BE ABSORBED! Dry skin. Redness. (Further see Inhalation).	Protective gloves. Protective clothing.	First rinse with plenty of water, then remove contaminated clothes and rinse again. Refer for medical attention.
•EYES	Redness. Pain.	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(Further see Inhalation).	Do not eat, drink, or smoke during work.	Give nothing to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area! Consult an expert! Remove all ignition sources. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: complete protective clothing including self-contained breathing apparatus.	Fireproof. Separated from oxidants , food and feedstuffs . Cool. Store in an area without drain or sewer access.	Airtight. Unbreakable packaging; put breakable packaging into closed unbreakable container. Do not transport with food and feedstuffs. F symbol T symbol R: 11-36/38-48/23-62-63 S: 1/2-16-33-36/37-45 UN Hazard Class: 3 UN Subsidiary Risks: 6.1 UN Packing Group: I

ICSC: 0022	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0022

CARBON DISULFIDE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:

COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

The vapour is heavier than air and may travel along the ground; distant ignition possible. As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:

May explosively decompose on shock, friction, or concussion. May explode on heating. The substance may ignite spontaneously on contact with hot surfaces with air producing toxic fumes of sulphur dioxide (see ICSC 0074). Reacts violently with oxidants causing fire and explosion hazard. Attacks some forms of plastic, rubber and coating.

OCCUPATIONAL EXPOSURE LIMITS:

TLV: 10 ppm; (skin); Intended change. BEI issued; (ACGIH 2004).
MAK: 5 ppm, 16 mg/m^3; skin absorption (H);
Peak limitation category: II(2);
Pregnancy risk group: B;
(DFG 2007).
Track 08-2006
OSHA PEL†: TWA 20 ppm C 30 ppm 100 ppm (30-minute maximum peak)
NIOSH REL: TWA 1 ppm (3 mg/m^3) ST 10 ppm (30 mg/m^3) skin
NIOSH IDLH: 500 ppm See: 75150

ROUTES OF EXPOSURE:

The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:

A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:

The substance irritates the eyes, the skin and the respiratory tract. Swallowing the liquid may cause aspiration into the lungs with the risk of chemical pneumonitis. The substance may cause effects on the central nervous system . Exposure could cause lowering of consciousness. Exposure between 200 and 500 ppm could cause death.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:

Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the cardiovascular system and nervous system , resulting in coronary heart disease and severe neurobehavioural effects, polyneuritis, psychoses. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES	Boiling point: 46°C Melting point: -111°C Relative density (water = 1): 1.26 Solubility in water, g/100 ml at 20°C: 0.2 Vapour pressure, kPa at 25°C: 48	Relative vapour density (air = 1): 2.63 Flash point: -30°C c.c. Auto-ignition temperature: 90°C Explosive limits, vol% in air: 1-50 Octanol/water partition coefficient as log Pow: 1.84
ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms.	

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

Transport Emergency Card: TEC (R)-30S1131

NFPA Code: H 3; F 4; R 0;

ADDITIONAL INFORMATION

ICSC: 0022 **CARBON DISULFIDE**

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Page last reviewed: July 22, 2015

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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CHROMIUM

ICSC: 0029

Chrome Cr Atomic mass: 52.0 (powder) ICSC # 0029	CAS # 7440-47-3 RTECS # GB4200000 October 27, 2004 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible under specific conditions.	No open flames if in powder form.	In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION		Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough.	Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.
•EYES	Redness.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Personal protection: P2 filter respirator for harmful particles.		

ICSC: 0029	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0029

CHROMIUM

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** GREY POWDER **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** Chromium is a catalytic substance and may cause reaction in contact with many organic and inorganic substances , causing fire and explosion hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: (as Cr metal, Cr(III) compounds) 0.5 mg/m^3 as TWA; A4; (ACGIH 2004). MAK not established. OSHA PEL*: TWA 1 mg/m^3 See Appendix C *Note: The PEL also applies to insoluble chromium salts. NIOSH REL: TWA 0.5 mg/m^3 See Appendix C NIOSH IDLH: 250 mg/m^3 (as Cr) See: 7440473	**ROUTES OF EXPOSURE:** **INHALATION RISK:** A harmful concentration of airborne particles can be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** May cause mechanical irritation tothe eyesandthe respiratory tract. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 2642°C Melting point: 1900°C Density: 7.15 g/cm^3	Solubility in water: none

ENVIRONMENTAL DATA	

NOTES

The surface of the chromium particles is oxidized to chromium(III)oxide in air. See ICSC 1531 Chromium(III) oxide.

ADDITIONAL INFORMATION

ICSC: 0029	**CHROMIUM**

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Page last reviewed: July 22, 2015

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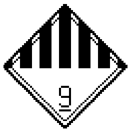
CHRYSENE

ICSC: 1672

Benzoaphenanthrene 1,2-Benzophenanthrene 1,2,5,6-Dibenzonaphthalene $C_{18}H_{12}$ Molecular mass: 228.3 ICSC # 1672 	CAS # 218-01-9 RTECS # GC0700000 UN # 3077 EC # 601-048-00-0 October 12, 2006 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray. Dry powder. Foam. Carbon dioxide.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE	See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.	AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.

•EYES		Safety goggles	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: P3 filter respirator for toxic particles. Do NOT let this chemical enter the environment. Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Separated from strong oxidants, Provision to contain effluent from fire extinguishing. Store in an area without drain or sewer access.	T symbol N symbol R: 45-68-50/53 S: 53-45-60-61 UN Hazard Class: 9 UN Packing Group: III Signal: Warning Health haz-Enviro Suspected of causing cancer Very toxic to aquatic life Toxic to aquatic life with long lasting effects

ICSC: 1672	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 1672

CHRYSENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS TO BEIGE CRYSTALS OR POWDER **PHYSICAL DANGERS:** Dust explosion possible if in powder or granular form, mixed with air. **CHEMICAL DANGERS:** The substance decomposes on burning producing toxic fumes . Reacts violently with strong oxidants. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: A3 (confirmed animal carcinogen with unknown relevance to humans); (ACGIH 2006). MAK: skin absorption (H); Carcinogen category: 2 (DFG 2007).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol, through the skin and by ingestion. **INHALATION RISK:** A harmful concentration of airborne particles can be reached quickly when dispersed . **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 448°C Melting point: 254 - 256°C Density: 1.3 g/cm^3	Solubility in water: very poor Octanol/water partition coefficient as log Pow: 5.9

ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. Bioaccumulation of this chemical may occur in seafood. It is strongly advised that this substance does not enter the environment.

N O T E S

Depending on the degree of exposure, periodic medical examination is suggested. Do NOT take working clothes home. This substance does not usually occur as a pure substance but as a component of polyaromatic hydrocarbon (PAH) mixtures. Human population studies have associated PAH's exposure with cancer and cardiovascular diseases.

Transport Emergency Card: TEC (R)-90GM7-III

Card has been partially updated in January 2008: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 1672 **CHRYSENE**

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Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries NIOSH®

COPPER

ICSC: 0240

Cu Atomic mass: 63.5 (powder) ICSC # 0240	CAS # 7440-50-8 RTECS # GL5325000 September 24, 1993 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Special powder, dry sand, NO other agents.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Cough. Headache. Shortness of breath. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers. Carefully collect remainder. Then remove to safe place. (Extra personal protection: P2 filter respirator for harmful particles).	Separated from - See Chemical Dangers.	

ICSC: 0240	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0240

COPPER

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** RED POWDER, TURNS GREEN ON EXPOSURE TO MOIST AIR. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Shock-sensitive compounds are formed with acetylenic compounds, ethylene oxides and azides. Reacts with strong oxidants like chlorates, bromates and iodates, causing explosion hazard. **OCCUPATIONAL EXPOSURE LIMITS:** TLV: (Fume) 0.2 mg/m^3; TLV: (Dusts & mists as Cu) 1 mg/m^3 (ACGIH 2007). MAK: 0.1 mg/m^3 (Inhalable fraction) Peak limitation category: II(2) Pregnancy risk group: C (DFG 2007). OSHA PEL*: TWA 1 mg/m^3 *Note: The PEL also applies to other copper compounds (as Cu) except copper fume. NIOSH REL*: TWA 1 mg/m^3 *Note: The REL also applies to other copper compounds (as Cu) except Copper fume. NIOSH IDLH: 100 mg/m^3 (as Cu) See: 7440508	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** Inhalation of fumes may cause metal fume fever. See Notes. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** Repeated or prolonged contact may cause skin sensitization.
PHYSICAL PROPERTIES	Boiling point: 2595°C Melting point: 1083°C Relative density (water = 1): 8.9	Solubility in water: none

ENVIRONMENTAL DATA	

N O T E S

The symptoms of metal fume fever do not become manifest until several hours.
Card has been partially updated in January 2008: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0240 **COPPER**

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **CRESOLS (mixed isomers)**

CAS Number: 1319-77-3
DOT Number: UN 2076
DOT Hazard Class: 6.1 (Poison)

RTK Substance number: 0537
Date: December 2006 Revision: March 2007

HAZARD SUMMARY

- **Cresols** can affect you when breathed in and by passing through your skin.
- **Cresols** are CORROSIVE CHEMICALS and contact can severely irritate and burn the skin and eyes with possible eye damage.
- Breathing **Cresols** can irritate the nose, throat and lungs.
- High exposure to **Cresols** can cause collapse and death within minutes.
- **Cresols** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- **Cresols** may damage the liver and kidneys.
- Long-term exposure can lead to chronic poisoning, with trouble swallowing, loss of appetite, vomiting, diarrhea, headache and dizziness.

IDENTIFICATION

Cresols are colorless to yellowish or pink crystalline (sand-like) solids or oily liquids. They are used in disinfectants, fumigants and photographic developers.

REASON FOR CITATION

- **Cresols** are on the Hazardous Substance List because they are regulated by OSHA and cited by ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.
- These chemicals are on the Special Health Hazard Substance List because they are **CORROSIVE**.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.
- **ODOR THRESHOLD = 0.0006 ppm**.
- The range of accepted odor threshold values is quite broad. Caution should be used in relying on odor alone as a warning of potentially hazardous exposures.

WORKPLACE EXPOSURE LIMITS

The following exposure limits are for all isomers of **Cresols**:

OSHA:	The legal airborne permissible exposure limit (PEL) is **5 ppm** averaged over an 8-hour workshift.
NIOSH:	The recommended airborne exposure limit is **2.3 ppm** averaged over a 10-hour workshift.
ACGIH:	The recommended airborne exposure limit is **5 ppm** averaged over an 8-hour workshift.

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Cresols** and at the end of the workshift.

* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Cresols** to potentially exposed workers.

This Fact Sheet is a summary source of information of <u>all potential</u> and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Cresols**:

* Contact can severely irritate and burn the skin and eyes with possible eye damage.
* Breathing **Cresols** can irritate the nose, throat and lungs.
* High exposure to **Cresols** can cause collapse and death within minutes.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Cresols** and can last for months or years:

Cancer Hazard

* While **Cresols** have not been identified as carcinogens, three specific isomers (*ortho, meta and para*) have been determined to be human carcinogens. **Cresols** should be handled with extreme caution.

Reproductive Hazard

* While **Cresols** have been tested, they are not classifiable as to their potential to cause reproductive harm.

Other Long-Term Effects

* **Cresols** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
* **Cresols** may damage the liver and kidneys.
* Long-term exposure can lead to chronic poisoning, with trouble swallowing, loss of appetite, vomiting, diarrhea, headache and dizziness.

MEDICAL

Medical Testing

For those with frequent or potentially high exposure (half the PEL or greater, or significant skin contact), the following are recommended before beginning work and at regular times after that:

* Evaluation by a qualified allergist, including careful exposure history and special testing, may help diagnose skin allergy.
* Liver and kidney function tests.

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

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

Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol can increase the liver damage caused by **Cresols**.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Cresols** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Cresols** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Cresols**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Cresols**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Cresols**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Cresols** are handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* For solid **Cresols**, use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

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

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

Clothing

- Avoid skin contact with **Cresols**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- Safety equipment manufacturers recommend *Butyl Rubber*; *Neoprene*; and *Viton*® for gloves, and DuPont *Responder*® and *DuPont Tychem*® *BR/LV*, *SL* and *TK* for protective clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- For solid **Cresols** wear eye protection with side shields or goggles.
- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **2.3 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge and particulate prefilters. Increased protection is obtained from full facepiece powered-air purifying respirators.
- If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Cresols**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **23 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **250 ppm** is immediately dangerous to life and health. If the possibility of exposure above **250 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

HANDLING AND STORAGE

- Prior to working with **Cresols** you should be trained on its proper handling and storage.
- **Cresols** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); METALS (such as POTASSIUM, SODIUM, MAGNESIUM and ZINC); AMINES; and AMIDES.
- Store in tightly closed containers in a cool, well-ventilated area away from LIGHT and HIGH TEMPERATURES.
- Sources of ignition, such as smoking and open flames, are prohibited where **Cresols** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Don't all chemicals cause cancer?

A: No. Most chemicals tested by scientists are not cancer-causing.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?

A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage <u>sperm</u> and <u>eggs</u>, possibly leading to birth defects.

Q: Who is at the greatest risk from reproductive hazards?

A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the <u>ability</u> to have children, so both men and women of childbearing age are at high risk.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

<u>Industrial Hygiene Information</u>

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

<u>Medical Evaluation</u>

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

<u>Public Presentations</u>

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

<u>Right to Know Information Resources</u>

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name:	**CRESOLS (mixed isomers)**
DOT Number:	**UN 2076**
DOT Hazard Class:	**6.1 (Poison)**
NAERG Code:	**153**
CAS Number:	**1319-77-3**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	2
REACTIVITY	-	0
COMBUSTIBLE CORROSIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

FIRE HAZARDS

* **Cresols** are COMBUSTIBLE.
* Use dry chemical, CO_2, or foam extinguishing agents.
* POISONOUS GASES ARE PRODUCED IN FIRE.
* **Cresol** *vapors* can become explosive when exposed to heat or flames.
* CONTAINERS MAY EXPLODE IN FIRE.
* Use water spray to keep fire-exposed containers cool.
* Use water spray to reduce vapors.
* If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

SPILLS AND EMERGENCIES

If liquid **Cresols** are spilled or leaked, or solid **Cresols** are spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
* Remove all ignition sources.
* Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
* Collect solid material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate and wash area after clean-up is complete.
* It may be necessary to contain and dispose of **Cresols** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

==

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE (See page 3)

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

* Immediately flush with large amounts of water. Continue without stopping for at least 30 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

Skin Contact

* Quickly remove contaminated clothing. Immediately wash area with large amounts of water. Seek medical attention immediately.

Breathing

* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 0.35 mm Hg at 68°F (20°C)
Flash Point: 178°F to 187°F (81°C to 86°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:

Phenol, Methyl-

Cresols is the common name for any combination of the following isomers:

meta-Cresol	CAS # 108-39-4	RTK Sub. No. 1161
ortho-Cresol	CAS # 95-48-7	RTK Sub. No. 1426
para-Cresol	CAS # 106-44-5	RTK Sub. No. 1468

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NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **CYANIDE**

CAS Number: 57-12-5
DOT Number: UN 1588
DOT Hazard Class: 6.1 (Poison)

RTK Substance number: 0553
Date: February 2007

HAZARD SUMMARY

* **Cyanide** can affect you when breathed in and by passing through your skin.
* Exposure to **Cyanide** can irritate the eyes, nose, and throat.
* High exposure to **Cyanide** can cause *Cyanide poisoning* with headache, weakness, confusion, nausea, pounding of the heart, coma and even death.
* Repeated lower exposure to **Cyanide** can cause nose bleeds and sores in the nose, and/or enlargement of the thyroid gland.
* If **Cyanide** is involved in a fire it can release *Hydrogen Cyanide gas*. CONSULT THE NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES HAZARDOUS SUBSTANCE FACT SHEET ON HYDROGEN CYANIDE.

IDENTIFICATION

Cyanide is usually found joined with other chemicals. It can range in color and form from a colorless gas (*Hydrogen Cyanide*) to a white solid (*Sodium Cyanide* and *Potassium Cyanide*). These compounds have a faint to bitter, almond-like odor. **Cyanide** compounds are used as fumigants and pesticides, in electrolysis, electroplating and welding, and in making a wide variety of products such as paper, drugs, dyes and fertilizers. They are also found or produced naturally by certain plants, bacteria, fungi, and algae.

REASON FOR CITATION

* **Cyanide** is on the Hazardous Substance List because it is regulated by OSHA and cited by DOT, DEP, IRIS and EPA.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **5 mg/m^3** averaged over an 8-hour workshift.

* The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Cyanide** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Cyanide** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Cyanide**:

* Exposure to **Cyanide** can irritate the eyes, nose, and throat.
* High exposure to **Cyanide** can cause *Cyanide poisoning* with headache, weakness, confusion, nausea, pounding of the heart, coma and even death.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Cyanide** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Cyanide** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Cyanide** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* Repeated lower exposure to **Cyanide** can cause nose bleeds and sores in the nose.
* **Cyanide** can cause enlargement of the thyroid gland and may interfere with normal thyroid function.

MEDICAL

Medical Testing

Before beginning employment and at regular times after that, (at least annually), the following is recommended:

* Urine thiocyanate levels

If symptoms develop or overexposure is suspected, the following are recommended:

* Blood **Cyanide** level
* Complete blood count
* Evaluation of thyroid function

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

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

Mixed Exposures

* Since cigarette smoke also contains some **Cyanide**, smokers may have somewhat higher blood **Cyanide** and urine thiocyanate levels.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Cyanide** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Cyanide** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Cyanide**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Cyanide**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Cyanide**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Cyanide** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.
* For solid **Cyanide** compounds, use a vacuum to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

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

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

Clothing

* Avoid skin contact with **Cyanide**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* Safety manufacturers recommend *Silver Shield/4H*®, and *DuPont Tychem*® *BR/LV* and *Tychem*®*TK* as protective materials for various **Cyanide** *compounds*.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* For solid **Cyanide** *compounds,* wear eye protection with side shields or goggles.
* Wear indirect-vent, impact and splash resistant goggles when working with liquids.
* Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

* Where the potential exists for exposure over **5 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
* Exposure to **25 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **25 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

HANDLING AND STORAGE

* Prior to working with **Cyanide** you should be trained on its proper handling and storage.
* **Cyanide** in contact with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and ACID SALTS releases highly flammable *Hydrogen Cyanide gas*.
* **Cyanide** *compounds* are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); AMINES; CALCIUM HYDROXIDE; CAUSTICS; AMMONIA; SODIUM CARBONATE; IRON and MAGNESIUM.
* Store in tightly closed containers in a cool, well-ventilated area away from WATER and MOISTURE.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

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The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

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DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name:	**CYANIDE**
DOT Number:	**UN 1588**
DOT Hazard Class:	**6.1 (Poison)**
NAERG Code:	**157**
CAS Number:	**57-12-5**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	0 (compounds)	4 (gas)
REACTIVITY	0 (compounds)	2 (gas)

DO NOT USE WATER OR CO_2
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

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

FIRE HAZARDS

- Extinguish fire using an agent suitable for type of surrounding fire. Solid **Cyanide** *compounds* do not burn.
- DO NOT USE WATER or CO_2 extinguishers as flammable *Hydrogen Cyanide gas* may be released.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Cyanide* and *Nitrogen Oxides*.
- CONTAINERS MAY EXPLODE IN FIRE.
- If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

SPILLS AND EMERGENCIES

If solid **Cyanide** *compounds* are spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Cover with a noncombustible material and shovel into a dry container for disposal.
- Flush spill area with *Hypochlorite solution*.
- DO NOT USE WATER.
- Ventilate the area of spill or leak after clean-up is complete.
- It may be necessary to contain and dispose of **Cyanide** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE (See page 3)

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention immediately.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

Antidotes and Special Procedures

- Use *Amyl Nitrite* capsules if symptoms develop. All area employees should be trained regularly in emergency treatment of *Cyanide* poisoning and in CPR. A *Cyanide* antidote kit MUST be rapidly available and ingredients replaced every 1 to 2 years to ensure freshness.

PHYSICAL DATA

Water Solubility: Soluble

OTHER COMMONLY USED NAMES

Chemical Name:

Cyanide

Other Name:

Cyanide Anion

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries
NIOSH®

DIBENZO(a,h)ANTHRACENE

ICSC: 0431

1,25,6-Dibenzanthracene $C_{22}H_{14}$ Molecular mass: 278.4 ICSC # 0431	CAS # 53-70-3 RTECS # HN2625000 EC # 601-041-00-2 October 23, 1995 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Water spray, powder.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN	Redness. Swelling. Itching.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness.	Face shield or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING

Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: P3 filter respirator for toxic particles.	Well closed.	T symbol N symbol R: 45-50/53 S: 53-45-60-61

ICSC: 0431	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0431

DIBENZO(a,h)ANTHRACENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** COLOURLESS CRYSTALLINE POWDER. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation, through the skin and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the skin , resulting in photosensitization. This substance is probably carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 524°C Melting point: 267°C Relative density (water = 1): 1.28	Solubility in water: none Octanol/water partition coefficient as log Pow: 6.5

ENVIRONMENTAL DATA	Bioaccumulation of this chemical may occur in seafood.

NOTES

This is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, it may be encountered as a laboratory chemical in its pure form. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. DBA is a commonly used name. This substance is one of many polycyclic aromatic hydrocarbons (PAH). Card has been partly updated in October 2005. See section EU classification.

ADDITIONAL INFORMATION

ICSC: 0431 **DIBENZO(a,h)ANTHRACENE**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **DIBENZOFURAN**

CAS Number: 132-64-9
DOT Number: None
DOT Hazard Class: None

RTK Substance number: 2230
Date: May 1998 Revision: December 2005

HAZARD SUMMARY

- **Dibenzofuran** can affect you when breathed in and by passing through your skin.
- **Dibenzofuran** can cause skin irritation.
- Exposure to **Dibenzofuran** can irritate the eyes, nose and throat.
- Repeated contact may cause skin growths, rashes and changes in skin color. The rash may be made worse by exposure to sunlight.
- *CONSULT THE NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES HAZARDOUS SUBSTANCE FACT SHEET ON COAL TAR.*

IDENTIFICATION

Dibenzofuran is a white, crystalline (sand-like) powder, which is derived from *Coal Tar*. It is used as an insecticide and to make other chemicals.

REASON FOR CITATION

- **Dibenzofuran** is on the Hazardous Substance List because it is cited by DEP, IRIS and EPA.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Dibenzofuran**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

- It should be recognized that **Dibenzofuran** can be absorbed through your skin, thereby increasing your exposure.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Dibenzofuran** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Dibenzofuran** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Dibenzofuran**:

* **Dibenzofuran** can cause skin irritation.
* Exposure to **Dibenzofuran** can irritate the eyes, nose and throat.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Dibenzofuran** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Dibenzofuran** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Dibenzofuran** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* Repeated contact may cause skin growths, rashes and changes in skin color. The rash may be made worse by exposure to sunlight.

MEDICAL

Medical Testing

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

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

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

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Dibenzofuran** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Dibenzofuran** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Dibenzofuran**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Dibenzofuran**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Dibenzofuran**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Dibenzofuran** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

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

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

Clothing

* Avoid skin contact with **Dibenzofuran**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.

* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear eye protection with side shields or goggles.

* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

* For field applications check with your supervisor and your safety equipment supplier regarding the appropriate respiratory equipment.

* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.

* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Dibenzofuran**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.

* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.

* Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

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DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

IRIS is the Integrated Risk Information System database of the federal EPA.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name:	**DIBENZOFURAN**
DOT Number:	**None**
DOT Hazard Class:	**None**
NAERG Code:	**No Citation**
CAS Number:	**132-64-9**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	1	-
REACTIVITY	Not Found	Not Rated
COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE		

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

FIRE HAZARDS

- **Dibenzofuran** is a COMBUSTIBLE SOLID.
- Use dry chemical, CO_2, water spray, an alcohol-resistant foam or other foaming agent.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

SPILLS AND EMERGENCIES

If **Dibenzofuran** is spilled, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- Remove all ignition sources.
- Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Dibenzofuran** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

===

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

===

HANDLING AND STORAGE

- Prior to working with **Dibenzofuran** you should be trained on its proper handling and storage.
- **Dibenzofuran** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Dibenzofuran** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

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

Breathing

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

PHYSICAL DATA

Flash Point: greater than 200°F (94°C)
Water Solubility: Slightly soluble

OTHER COMMONLY USED NAMES

Chemical Name:

Dibenzofuran

Other Names:

2,2’-Biphenylene Oxide; Diphenylene Oxide

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

Right to Know
Hazardous Substance Fact Sheet

Common Name: **DIETHYL PHTHALATE**

Synonyms: DEP; Diethyl 1,2-Benzenecarboxylate; Ethyl Phthalate
Chemical Name: 1,2-Benzenedicarboxylic Acid, Diethyl Ester
Date: July 1996 Revision: February 2012

CAS Number: 84-66-2
RTK Substance Number: 0707
DOT Number: UN 3082

Description and Use

Diethyl Phthalate is an odorless, colorless, oily liquid. It is used in making plastics, insecticides, cosmetics and aspirin, and is found in toothbrushes, automobile parts, toys, tools, and food packaging.

Reasons for Citation

- **Diethyl Phthalate** is on the Right to Know Hazardous Substance List because it is cited by ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.

SEE GLOSSARY ON PAGE 5.

FIRST AID

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

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

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	-	1
FLAMMABILITY	-	1
REACTIVITY	-	0
POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **Diethyl Phthalate** can affect you when inhaled and may pass through the skin.
- Contact can irritate the skin and eyes.
- Inhaling **Diethyl Phthalate** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Diethyl Phthalate** can cause headache, dizziness and nausea.
- High or repeated exposure may damage the nervous system causing numbness, “pins and needles,” and/or weakness in the hands and feet.

Workplace Exposure Limits

NIOSH: The recommended airborne exposure limit (REL) is **5 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **5 mg/m^3** averaged over an 8-hour workshift.

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

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

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

Health Hazard Information

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

- Contact can irritate the skin and eyes.
- Inhaling **Diethyl Phthalate** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Diethyl Phthalate** can cause headache, dizziness and nausea.

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

Cancer Hazard
- While **Diethyl Phthalate** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- There is no evidence that **Diethyl Phthalate** affects reproduction. This is based on test results presently available to the NJDOH from published studies.

Other Effects
- High or repeated exposure may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.

Medical

Medical Testing
If symptoms develop or overexposure is suspected, the following is recommended:

- Exam of the nervous system

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

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

Workplace Controls and Practices

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

The following work practices are also recommended:

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

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Diethyl Phthalate**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Diethyl Phthalate** are Butyl, Nitrile, Neoprene and Viton.
- The recommended protective clothing materials for *Esters, Carboxylic* are Tychem® F, BR, CSM and TK or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

Respiratory Protection

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

- Where the potential exists for exposure over **5 mg/m^3**, use a negative pressure, air-purifying, particulate filter respirator with an R or P95 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Diethyl Phthalate**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for high exposure exists, use a supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

Fire Hazards

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

- **Diethyl Phthalate** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. DO NOT use water jet directly on **Diethyl Phthalate**.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Phthalic Anhydride.*
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

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

If **Diethyl Phthalate** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- DO NOT wash into sewer.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Diethyl Phthalate** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Diethyl Phthalate** you should be trained on its proper handling and storage.

- **Diethyl Phthalate** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area away from WATER and PLASTICS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Diethyl Phthalate** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **DIETHYL PHTHALATE**

Synonyms: DEP; Diethyl 1,2-Benzenecarboxylate; Ethyl Phthalate
CAS No: 84-66-2
Molecular Formula: $C_{12}H_{14}O_4$
RTK Substance No: 0707
Description: Odorless, colorless, oil liquid

HAZARD DATA

Hazard Rating

1 - Health

1 - Fire

0 - Reactivity

DOT#: UN 3082

ERG Guide #: 171

Hazard Class: 9
(Environmentally Hazardous Substance)

Firefighting

Diethyl Phthalate may burn, but does not readily ignite.

Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. DO NOT use water jet directly on **Diethyl Phthalate**.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Phthalic Anhydride.*

Use water spray to keep fire-exposed containers cool.

Reactivity

Diethyl Phthalate is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

Diethyl Phthalate may attack plastics.

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

Diethyl Phthalate may be hazardous to the environment, especially to fish.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	322°F (161°C)
LEL:	0.7%
UEL:	Unknown
Auto Ignition Temp:	855°F (457°C)
Vapor Density:	7.7 (air = 1)
Vapor Pressure:	0.002 mm Hg at 68°F (20°C)
Specific Gravity:	1.2 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	568°F (298°C)
Freezing Point:	-41°F (-40.6°C)
Molecular Weight:	222.3

EXPOSURE LIMITS

NIOSH: 5 mg/m^3, 10-hr TWA

ACGIH: 5 mg/m^3, 8-hr TWA

The Protective Action Criteria values are:
PAC-1 = 15 mg/m^3 PAC-2 = 100 mg/m^3
PAC-3 = 300 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Nitrile, Neoprene and Viton (>8-hr breakthrough)
Coveralls:	Tychem® F, BR, CSM and TK (>8-hr breakthrough for *Esters, Carboxylic*)
Respirator:	>5 mg/m^3 - full facpiece APR with *P100 filters* Fire or >15 $mg/\ m^3$ - SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation (skin absorbable)
Inhalation:	Nose and throat irritation with coughing and wheezing

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

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

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

February 2012

NJ Health
New Jersey Department of Health

Right to Know
Hazardous Substance Fact Sheet

Common Name: **DI-n-BUTYL PHTHALATE**

Synonyms: n-Butyl Phthalate; DBP; Dibutyl 1,2-Benzenedicarboxylate

Chemical Name: 1,2-Benzenedicarboxylic Acid, Dibutyl Ester

Date: June 2001 Revision: February 2010

CAS Number: 84-74-2

RTK Substance Number: 0773

DOT Number: UN 3082

Description and Use

Di-n-Butyl Phthalate is a colorless to slightly yellow, oily liquid with a slight odor. It is used as an insecticide repellant in clothing, and as a plasticizer and solvent.

Reasons for Citation

- **Di-n-Butyl Phthalate** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

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

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

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	-	2
FLAMMABILITY	-	1
REACTIVITY	-	0
TERATOGEN COMBUSTIBLE POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **Di-n-Butyl Phthalate** can affect you when inhaled and by passing through the skin.
- **Di-n-Butyl Phthalate** may be a TERATOGEN. HANDLE WITH EXTREME CAUTION.
- **Di-n-Butyl Phthalate** may cause reproductive damage. HANDLE WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- Inhaling **Di-n-Butyl Phthalate** can irritate the nose and throat.
- Exposure to **Di-n-Butyl Phthalate** can cause headache, dizziness, nausea and seizures.
- **Di-n-Butyl Phthalate** may affect the nervous system and kidneys.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **5 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **5 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **5 mg/m^3** averaged over an 8-hour workshift.

- **Di-n-Butyl Phthalate** may be a teratogen in humans. All contact with this chemical should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Di-n-Butyl Phthalate**:

- Contact can irritate the skin and eyes.
- Inhaling **Di-n-Butyl Phthalate** can irritate the nose and throat.
- Exposure to **Di-n-Butyl Phthalate** can cause headache, dizziness, nausea and seizures.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Di-n-Butyl Phthalate** and can last for months or years:

Cancer Hazard

- While **Di-n-Butyl Phthalate** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard

- **Di-n-Butyl Phthalate** may be a TERATOGEN in humans since it is a teratogen in animals.
- **Di-n-Butyl Phthalate** may damage the developing fetus.
- **Di-n-Butyl Phthalate** may damage the testes (male reproductive glands).

Other Effects

- **Di-n-Butyl Phthalate** may affect the nervous system and kidneys.

Medical

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Kidney function tests

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

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

Workplace Controls and Practices

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

The following work practices are also recommended:

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

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Di-n-Butyl Phthalate**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl, Nitrile, Silver Shield®/4H® and Viton for gloves, and Tychem® BR, Responder®, and TK, or the equivalent, as protective clothing materials for *Esters*, *carboxylic*.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.

Respiratory Protection

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

- Where the potential exists for exposure over **5 mg/m^3**, use a NIOSH approved negative pressure, air-purifying, particulate filter respirator with an N, R or P95 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Di-n-Butyl Phthalate**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **50 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **4,000 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **4,000 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

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

- **Di-n-Butyl Phthalate** is a COMBUSTIBLE LIQUID.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- Water jets may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

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

If **Di-n-Butyl Phthalate** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Ventilate area of spill or leak.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Di-n-Butyl Phthalate** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Di-n-Butyl Phthalate** you should be trained on its proper handling and storage.

- **Di-n-Butyl Phthalate** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Di-n-Butyl Phthalate** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **DI-n-BUTYL PHLTHALATE**

Synonyms: n-Butyl Phthalate; DBP; Dibutyl 1,2-Benzenedicarboxylate
CAS No: 84-74-2
Molecular Formula: $C_{16}H_{22}O_4$
RTK Substance No: 0773
Description: Colorless to slightly yellow, oily liquid with a slight odor

HAZARD DATA

Hazard Rating

2 - Health

1 - Fire

0 - Reactivity

DOT#: UN 3082

ERG Guide #: 171

Hazard Class: 9
(Environmentally Hazardous Substance)

Firefighting

COMBUSTIBLE LIQUID

Use dry chemical, CO_2, water spray or foam as extinguishing agents.

Water jets may not be effective in fighting fires.

POISONOUS GASES ARE PRODUCED IN FIRE.

Use water spray to keep fire-exposed containers cool.

Reactivity

Di-n-Butyl Phthalate is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

Di-n-Butyl Phthalate is toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Faint odor (*aromatic*)
Flash Point:	315°F (157°C)
LEL:	0.5%
UEL:	2.5%
Auto Ignition Temp:	757°F (403°C)
Vapor Density:	9.6 (air = 1)
Vapor Pressure:	<1 mm Hg at 68°F (20°C)
Specific Gravity:	1.0 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	644°F (340°C)
Freezing Point:	-31°F (-35°C)
Molecular Weight:	278.34

EXPOSURE LIMITS

OSHA:	5 mg/m^3, 8-hr TWA
NIOSH:	5 mg/m^3, 10-hr TWA
ACGIH:	5 mg/m^3, 8-hr TWA
IDLH:	4,000 mg/m^3, 8-hr TWA

The Protective Action Criteria values are:

PAC-1 = 15 mg/m^3 PAC-2 = 75 mg/m^3 PAC-3 = 500 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Nitrile, SilverShield®/4H® and Viton (>8-hr breakthrough)
Coveralls:	Tychem® BR, Responder®, and TK (>8-hr breakthrough for *Esters*, *Carboxylic*)
Respirator:	>5 mg/m^3 - Full facepiece APR with *High efficiency filters* >50 mg/m^3 - SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose and throat irritation Headache, dizziness and seizures

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

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

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

February 2010

NEW JERSEY DEPARTMENT of HEALTH and SENIOR SERVICES

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **DI-n-OCTYL PHTHALATE**

CAS Number: 117-84-0
DOT Number: None

RTK Substance number: 0787
Date: January 1996 Revision: April 2002

HAZARD SUMMARY

- **Di-n-Octyl Phthalate** can affect you when breathed in.
- Contact can irritate the skin and eyes.
- Breathing **Di-n-Octyl Phthalate** can irritate the nose and throat causing coughing and wheezing.
- High or repeated exposure may affect the liver.

IDENTIFICATION

Di-n-Octyl Phthalate is a colorless, oily liquid. It is used as a plasticizer in plastic and rubber materials.

REASON FOR CITATION

- **Di-n-Octyl Phthalate** is on the Hazardous Substance List because it is cited by DEP, NFPA and EPA.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Di-n-Octyl Phthalate**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Di-n-Octyl Phthalate**.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Di-n-Octyl Phthalate** to potentially exposed workers.

This Fact Sheet is a summary source of information of <u>all</u> <u>potential</u> and most severe health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Di-n-Octyl Phthalate**:

* Contact can irritate the skin and eyes.
* Breathing **Di-n-Octyl Phthalate** can irritate the nose and throat causing coughing and wheezing.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Di-n-Octyl Phthalate** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Di-n-Octyl Phthalate** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* There is limited evidence that **Di-n-Octyl Phthalate** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

Other Long-Term Effects

* High or repeated exposure may affect the liver.

MEDICAL

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Liver function tests.

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically pump liquid **Di-n-Octyl Phthalate** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Di-n-Octyl Phthalate** should change into clean clothing promptly.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Di-n-Octyl Phthalate**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Di-n-Octyl Phthalate**, immediately wash or shower to remove the chemical.
* Do not eat, smoke, or drink where **Di-n-Octyl Phthalate** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, applying cosmetics, smoking, or using the toilet.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

- * Avoid skin contact with **Di-n-Octyl Phthalate**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- * All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.
- * ACGIH recommends *Polyvinyl Chloride* as a protective material.

Eye Protection

- * Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- * Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- * Where the potential for overexposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

Q: Who is at the greatest risk from reproductive hazards?
A: Pregnant women are at greatest risk from chemicals that harm the developing fetus. However, chemicals may affect the ability to have children, so both men and women of childbearing age are at high risk.

Q: Should I be concerned if a chemical is a teratogen in animals?
A: Yes. Although some chemicals may affect humans differently than they affect animals, damage to animals suggests that similar damage can occur in humans.

Q: Can men as well as women be affected by chemicals that cause reproductive system damage?
A: Yes. Some chemicals reduce potency or fertility in both men and women. Some damage sperm and eggs, possibly leading to birth defects.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **DI-n-OCTYL PHTHALATE**
DOT Number: **None**
NAERG Code: **No Citation**
CAS Number: **117-84-0**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	1
REACTIVITY	-	0
POISONOUS GASES ARE PRODUCED IN FIRE		

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

FIRE HAZARDS

- **Di-n-Octyl Phthalate** may burn, but does not readily ignite.
- Use dry chemical, CO_2, or foam extinguishers.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Di-n-Octyl Phthalate** is spilled or leaked, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Di-n-Octyl Phthalate** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE

- Prior to working with **Di-n-Octyl Phthalate** you should be trained on its proper handling and storage.
- **Di-n-Octyl Phthalate** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).
- Store in tightly closed containers in a cool, well-ventilated area.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

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

Breathing

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: less than 2.6×10^{-6} mm Hg at 77°F (25°C)

Flash Point: 420°F (215°C)

Water Solubility: Very slightly soluble

OTHER COMMONLY USED NAMES

Chemical Name:

1,2-Benzenedicarboxylic Acid, Dioctyl Ester

Other Names:

Phthalic Acid, Dioctyl Ester; DNOP; Celluflex DOP; Dinopol NOP

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **BENZO(jk)FLUORENE**

CAS Number: 206-44-0
DOT Number: None

RTK Substance number: 2970
Date: September 2002

HAZARD SUMMARY

* **Benzo(jk)Fluorene** can affect you when breathed in.
* **Benzo(jk)Fluorene** may irritate the eyes on contact.

IDENTIFICATION

Benzo(jk)Fluorene is a yellow to green needle or crystal-shaped solid. It is found in *Polynuclear Aromatic Hydrocarbons* present in urban air emissions and cigarette smoke.

REASON FOR CITATION

* **Benzo(jk)Fluorene** is on the Hazardous Substance List because it is cited by EPA.
* Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

* Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
* If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

The following exposure limits are for *Coal Tar Pitch Volatiles*:

OSHA:	The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (*Benzene soluble fraction*) averaged over an 8-hour workshift.
NIOSH:	The recommended airborne exposure limit is **0.1 mg/m^3** (*Cyclohexane extractable fraction*) averaged over a 10-hour workshift.
ACGIH:	The recommended airborne exposure limit is **0.2 mg/m^3** (*Benzene soluble fraction*) averaged over an 8-hour workshift.

WAYS OF REDUCING EXPOSURE

* Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
* Wear protective work clothing.
* Wash thoroughly immediately after exposure to **Benzo(jk)Fluorene** and at the end of the workshift.
* Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Benzo(jk)Fluorene** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzo(jk)Fluorene**:

* **Benzo(jk)Fluorene** may irritate the eyes on contact.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(jk)Fluorene** and can last for months or years:

Cancer Hazard

* While **Benzo(jk)Fluorene** has been tested there is inadequate evidence of carcinogenicity in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Benzo(jk)Fluorene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* **Benzo(jk)Fluorene** has not been tested for other chronic (long-term) health effects.

MEDICAL

Medical Testing

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

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Benzo(jk)Fluorene** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Benzo(jk)Fluorene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Benzo(jk)Fluorene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Benzo(jk)Fluorene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Benzo(jk)Fluorene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Benzo(jk)Fluorene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

- Avoid skin contact with **Benzo(jk)Fluorene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear impact resistant eye protection with side shields or goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

- NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
- If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Benzo(jk)Fluorene**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential for overexposure exists, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?
A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<<

Common Name: **BENZO(jk)FLUORENE**
DOT Number: **None**
NAERG Code: **No Citation**
CAS Number: **206-44-0**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	1	-
REACTIVITY	0	-
POISONOUS GASES ARE PRODUCED IN FIRE		

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

FIRE HAZARDS

- Use dry chemical, CO_2, water spray, or foam extinguishers.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Benzo(jk)Fluorene** is spilled, take the following steps:

- Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
- Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Benzo(jk)Fluorene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
- If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

HANDLING AND STORAGE

- Prior to working with **Benzo(jk)Fluorene** you should be trained on its proper handling and storage.
- Store in tightly closed containers in a cool, well-ventilated area away from LIGHT.

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

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

Breathing

- Remove the person from exposure.

PHYSICAL DATA

Vapor Pressure: 0.01 mm Hg at 68°F (20°C)
Flash Point: 405°F (207°C) (as *Coal Tar Pitch*)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:

Fluoranthene

Other Names:

1,2-(1,8-Naphthylene) Benzene; Idryl

Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **FLUORENE**

CAS Number: 86-73-7
DOT Number: None

RTK Substance number: 2993
Date: May 1999

HAZARD SUMMARY

- **Fluorene** can affect you when breathed in.
- **Fluorene** can irritate and burn the eyes and skin.

IDENTIFICATION

Fluorene is white crystalline plates. It is used in resinous products, dyestuffs, and as a chemical intermediate.

REASON FOR CITATION

- **Fluorene** is on the Hazardous Substance List because it is cited by HHAG and EPA.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

No occupational exposure limits have been established for **Fluorene**. This does not mean that this substance is not harmful. Safe work practices should always be followed.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Fluorene** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Fluorene** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Fluorene**:

* **Fluorene** can irritate and burn the eyes and skin.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Fluorene** and can last for months or years:

Cancer Hazard

* **Fluorene** has been tested but further studies are required to determine its ability to cause cancer.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Fluorene** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

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

MEDICAL

Medical Testing

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

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following control is recommended:

* Where possible, automatically transfer **Fluorene** from drums or other storage containers to process containers.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Fluorene** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Fluorene**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Fluorene**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Fluorene**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Fluorene** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

* Avoid skin contact with **Fluorene**. Wear protective gloves and clothing. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear impact resistant eye protection with side shields or goggles.
* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.
* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Fluorene**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
* Where the potential for high exposure exists, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?
A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?
A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?
A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?
A: Conditions which increase risk of exposure include <u>dust releasing operations</u> (grinding, mixing, blasting, dumping, etc.), <u>other physical and mechanical processes</u> (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and <u>"confined space" exposures</u> (working inside vats, reactors, boilers, small rooms, etc.).

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The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 292-5677 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

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

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

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

PEOSHA is the Public Employees Occupational Safety and Health Act, a state law which sets PELs for New Jersey public employees.

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

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

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **FLUORENE**
DOT Number: **None**
NAERG Code: **None**
CAS Number: **86-73-7**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	Not Found	Not Rated
REACTIVITY	Not Found	Not Rated
POISONOUS GASES ARE PRODUCED IN FIRE		

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

FIRE HAZARDS

* **Fluorene** may burn, but does not readily ignite.
* Use dry chemical, CO_2, water, alcohol or polymer foam extinguishers.
* POISONOUS GASES ARE PRODUCED IN FIRE.
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Fluorene** is spilled, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill until clean-up is complete.
* Collect powdered material in the most convenient and safe manner and deposit in sealed containers.
* Ventilate area after clean-up is complete.
* It may be necessary to contain and dispose of **Fluorene** as a HAZARDOUS WASTE. Contact your Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

==

FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: (609) 292-7172

==

HANDLING AND STORAGE

* Prior to working with **Fluorene** you should be trained on its proper handling and storage.
* **Fluorene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
* Store in tightly closed containers in a cool, well-ventilated area away from HEAT.

FIRST AID

In NJ, POISON INFORMATION 1-800-764-7661

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids.

Skin Contact

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

Breathing

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

PHYSICAL DATA

Vapor Pressure: 3.2×10^{-4} mm Hg at 68°F (20°C)
Flash Point: 302°F (151°C)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Other Names:

2,2'-Methylenebiphenyl; 9H-Fluorene; Diphenylenemethane

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NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

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beta-HEXACHLOROCYCLOHEXANE

ICSC: 0796

1-alpha,2-beta,3-alpha,4-beta,5-alpha,6-beta-Hexachlorocyclohexane beta-1,2,3,4,5,6-Hexachlorocyclohexane beta-Benzenehexachloride (beta-BHC) $C_6H_6Cl_6$ Molecular mass: 290.8 ICSC # 0796	CAS # 319-85-7 RTECS # GV4375000 EC # 602-042-00-0 November 24, 1998 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: all extinguishing agents allowed.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION	Cough. Sore throat. See Notes.	Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	MAY BE ABSORBED!	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.

•EYES		Safety goggles, or face shield.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Diarrhoea. Dizziness. Headache. Nausea. Vomiting. Tremors.	Do not eat, drink, or smoke during work.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: P2 filter respirator for harmful particles).	Well closed. Store in an area without drain or sewer access.	Note: C T symbol N symbol R: 21-25-40-50/53 S: 1/2-22-36/37-45-60-61

ICSC: 0796	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0796

beta-HEXACHLOROCYCLOHEXANE

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** CRYSTALLINE POWDER. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance decomposes in a fire, producing very toxic fumes including phosgene (see ICSC 0007) and hydrogen chloride (see ICSC 0163). **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established. MAK: (Inhalable fraction) 0.5 mg/m^3; Peak limitation category: II(8); skin absorption (H); (DFG 2006).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol, through the skin or by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** The substance may cause effects on the central nervous system. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may have effects on the blood, liver, kidney. This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxic effects upon human reproduction.
PHYSICAL PROPERTIES	Boiling point at 0,07 kPa: 60°C Melting point: 309°C Density: 1.9 g/cm^3	Solubility in water: none Vapour pressure, Pa at 20°C: 0.7 Octanol/water partition coefficient as log Pow: 3.8

ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. In the food chain important to humans, bioaccumulation takes place, specifically in seafood. The substance may cause long-term effects in the aquatic environment. It is strongly advised that this substance does not enter the environment.

NOTES

This substance is a component of the insecticide hexachlorocyclohexane (isomer mixture). Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Do NOT take working clothes home. Also consult ICSC # 0487 (Hexachlorocyclohexane).

Card has been partially updated in August 2007: see Storage, Occupational Exposure Limits, Environmental Data.

ADDITIONAL INFORMATION

ICSC: 0796 **beta-HEXACHLOROCYCLOHEXANE**

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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INDENO(1,2,3-cd)PYRENE

ICSC: 0730

o-Phenylenepyrene 2,3-Phenylenepyrene $C_{22}H_{12}$ Molecular mass: 276.3 ICSC # 0730	CAS # 193-39-5 RTECS # NK9300000 March 25, 1999 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE			In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		AVOID ALL CONTACT!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Well closed.	

ICSC: 0730	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0730

INDENO(1,2,3-cd)PYRENE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW CRYSTALS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Upon heating, toxic fumes are formed. **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established. MAK: Carcinogen category: 2; (DFG 2004).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation of its aerosol and through the skin. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** This substance is possibly carcinogenic to humans.
PHYSICAL PROPERTIES	Boiling point: 536°C Melting point: 164°C Solubility in water: none	Octanol/water partition coefficient as log Pow: 6.58

ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to air quality and water quality. Bioaccumulation of this chemical may occur in fish.

NOTES

Indeno(1,2,3-cd)pyrene is present as a component of polycyclic aromatic hydrocarbons (PAH) content in the environment usually resulting from the incomplete combustion or pyrolysis of organic matters, especially fossil fuels and tobacco.ACGIH recommends environment containing Indeno(1,2,3-c,d)pyrene should be evaluated in terms of the TLV-TWA for coal tar pitch volatile, as benzene soluble 0.2 mg/m^3. Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken. Card has been partly updated in October 2005. See section Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0730 **INDENO(1,2,3-cd)PYRENE**

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LEAD

ICSC: 0052

Lead metal Plumbum Pb (powder) ICSC # 0052	CAS # 7439-92-1 RTECS # OF7525000 August 10, 2002 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE	See EFFECTS OF LONG-TERM OR REPEATED EXPOSURE.	PREVENT DISPERSION OF DUST! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION	Abdominal pain. Nausea. Vomiting.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. Personal protection: P3 filter respirator for toxic particles.	Separated from food and feedstuffs and incompatible materials . See Chemical Dangers.	

ICSC: 0052	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0052

LEAD

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
BLUISH-WHITE OR SILVERY-GREY SOLID IN VARIOUS FORMS. TURNS TARNISHED ON EXPOSURE TO AIR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
On heating, toxic fumes are formed. Reacts with oxidants. Reacts with hot concentrated nitric acid, boiling concentrated hydrochloric acid and sulfuric acid. Attacked by pure water and by weak organic acids in the presence of oxygen.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.05 mg/m^3 as TWA; A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2004).
MAK:
Carcinogen category: 2; Germ cell mutagen group: 3A;
(DFG 2006).
EU OEL: as TWA 0.15 mg/m^3; (EU 2002).
OSHA PEL*: 1910.1025 TWA 0.050 mg/m^3 See Appendix C *Note: The PEL also applies to other lead compounds (as Pb) -- See Appendix C .
NIOSH REL*: TWA 0.050 mg/m^3 See Appendix C *Note: The REL also applies to other lead compounds (as Pb) -- See Appendix C .
NIOSH IDLH: 100 mg/m^3 (as Pb) See: 7439921

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and by ingestion.

INHALATION RISK:
A harmful concentration of airborne particles can be reached quickly when dispersed, especially if powdered.

EFFECTS OF SHORT-TERM EXPOSURE:

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the blood , bone marrow , central nervous system , peripheral nervous system and kidneys , resulting in anaemia, encephalopathy (e.g., convulsions), peripheral nerve disease, abdominal cramps and kidney impairment. Causes toxicity to human reproduction or development. This substance is probably carcinogenic to humans. fast track change Oct 06 - IARC 2A.

PHYSICAL PROPERTIES	Boiling point: 1740°C Melting point: 327.5°C	Density: 11.34 g/cm^3 Solubility in water: none
ENVIRONMENTAL DATA	Bioaccumulation of this chemical may occur in plants and in mammals. It is strongly advised that this substance does not enter the environment.	

NOTES

Depending on the degree of exposure, periodic medical examination is suggested. Do NOT take working clothes home. Card has been partly updated in April 2005. See section Occupational Exposure Limits. Card has been partly updated in October 2006: see section Occupational Exposure Limits, Effects Long Tem Exposure.

ADDITIONAL INFORMATION

ICSC: 0052 **LEAD**

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MERCURY

ICSC: 0056

Quicksilver Liquid silver Hg ICSC # 0056 	CAS # 7439-97-6 RTECS # OV4550000 UN # 2809 EC # 080-001-00-0 April 22, 2004 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Gives off irritating or toxic fumes (or gases) in a fire.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION	Risk of fire and explosion.		In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID EXPOSURE OF ADOLESCENTS AND CHILDREN!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Abdominal pain. Cough. Diarrhoea. Shortness of breath. Vomiting. Fever or elevated body temperature.	Local exhaust or breathing protection.	Fresh air, rest. Artificial respiration if indicated. Refer for medical attention.

•SKIN	MAY BE ABSORBED! Redness.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.
•EYES		Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work. Wash hands before eating.	Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Evacuate danger area in case of a large spill! Consult an expert! Ventilation. Collect leaking and spilled liquid in sealable non-metallic containers as far as possible. Do NOT wash away into sewer. Do NOT let this chemical enter the environment. Chemical protection suit including self-contained breathing apparatus.	Provision to contain effluent from fire extinguishing. Separated from food and feedstuffs . Well closed.	Special material. Do not transport with food and feedstuffs. T symbol N symbol R: 23-33-50/53 S: 1/2-7-45-60-61 UN Hazard Class: 8 UN Packing Group: III

ICSC: 0056	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0056

MERCURY

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
ODOURLESS, HEAVY AND MOBILE SILVERY LIQUID METAL.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. Reacts violently with ammonia and halogens causing fire and explosion hazard. Attacks aluminium and many other metals forming amalgams.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.025 mg/m^3 as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: 0.1 mg/m^3; Sh;
Peak limitation category: II(8);
Carcinogen category: 3B;
(DFG 2003).
OSHA PEL†: C 0.1 mg/m^3
NIOSH REL: Hg Vapor: TWA 0.05 mg/m^3 skin
Other: C 0.1 mg/m^3 skin
NIOSH IDLH: 10 mg/m^3 (as Hg)
See: 7439976

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation of its vapour and through the skin , also as a vapour!

INHALATION RISK:
A harmful contamination of the air can be reached very quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the skin. Inhalation of the vapours may cause pneumonitis. The substance may cause effects on the central nervous systemandkidneys. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the central nervous system and kidneys , resulting in irritability, emotional instability, tremor, mental and memory disturbances, speech disorders. May cause inflammation and discoloration of the gums. Danger of cumulative effects. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES	Boiling point: 357°C Melting point: -39°C Relative density (water = 1): 13.5 Solubility in water: none	Vapour pressure, Pa at 20°C: 0.26 Relative vapour density (air = 1): 6.93 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.009 Electrical conductivity (NOT on card): 1.04 x 10(+18)pS/m
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. In the food chain important to humans, bioaccumulation takes place, specifically in fish.	

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. No odour warning if toxic concentrations are present. Do NOT take working clothes home.

Transport Emergency Card: TEC (R)-80GC9-II+III

ADDITIONAL INFORMATION

ICSC: 0056 **MERCURY**

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METHYL ETHYL KETONE

ICSC: 0179

Ethyl methyl ketone 2-Butanone MEK Methyl acetone C_4H_8O / $CH_3COCH_2CH_3$ Molecular mass: 72.1 ICSC # 0179 	CAS # 78-93-3 RTECS # EL6475000 UN # 1193 EC # 606-002-00-3 March 25, 1998 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Highly flammable.	NO open flames, NO sparks, and NO smoking.	Powder, AFFF, foam, carbon dioxide.
EXPLOSION	Vapour/air mixtures are explosive.	Closed system, ventilation, explosion-proof electrical equipment and lighting. Do NOT use compressed air for filling, discharging, or handling. Use non-sparking handtools.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE			
•INHALATION	Cough. Dizziness. Drowsiness. Headache. Nausea. Vomiting.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse skin with plenty of water or shower.

•EYES	Redness. Pain.	Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Unconsciousness. (Furthersee Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT wash away into sewer. Personal protection: self-contained breathing apparatus.	Fireproof. Separated from strong oxidants, strong acids. Cool. Well closed.	Note: 6 F symbol Xi symbol R: 11-36-66-67 S: 2-9-16 UN Hazard Class: 3 UN Packing Group: II

ICSC: 0179	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0179

METHYL ETHYL KETONE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
The vapour is heavier than air and may travel along the ground; distant ignition possible.

CHEMICAL DANGERS:
Reacts violently withstrong oxidants andinorganic acids causing fire and explosion hazard. Attacks some plastic.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 200 ppm as TWA; 300 ppm as STEL; BEI issued; (ACGIH 2004).
MAK: 200 ppm, 600 mg/m^3; H; Peak limitation category: I(1); Pregnancy risk group: C;
(DFG 2004).
OSHA PEL†: TWA 200 ppm (590 mg/m^3)
NIOSH REL: TWA 200 ppm (590 mg/m^3) ST 300 ppm (885 mg/m^3)
NIOSH IDLH: 3000 ppm See: 78933

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation and by ingestion.

INHALATION RISK:
A harmful contamination of the air can be reached rather quickly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the respiratory tract . The substance may cause effects on the central nervous system. Exposure far above the OEL may result in unconsciousness.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. Animal tests show that this substance possibly causes toxic effects upon human reproduction.

PHYSICAL PROPERTIES	Boiling point: 80°C Melting point: -86°C Relative density (water = 1): 0.8 Solubility in water, g/100 ml at 20°C: 29 Vapour pressure, kPa at 20°C: 10.5 Relative vapour density (air = 1): 2.41	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.1 Flash point: -9°C (c.c.) Auto-ignition temperature: 505°C Explosive limits, vol% in air: 1.8-11.5 Octanol/water partition coefficient as log Pow: 0.29
ENVIRONMENTAL DATA		

NOTES

The odour warning when the exposure limit value is exceeded is insufficient. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

Transport Emergency Card: TEC (R)-30S1193

NFPA Code: H1; F3; R0.

ADDITIONAL INFORMATION

ICSC: 0179 **METHYL ETHYL KETONE**

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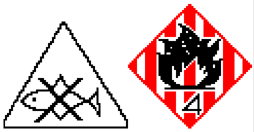
NAPHTHALENE

ICSC: 0667

Naphthene $C_{10}H_8$ Molecular mass: 128.18 ICSC # 0667 	CAS # 91-20-3 RTECS # QJ0525000 UN # 1334 (solid); 2304 (molten) EC # 601-052-00-2 April 21, 2005 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 80°C explosive vapour/air mixtures may be formed. Finely dispersed particles form explosive mixtures in air.	Prevent deposition of dust; closed system, dust explosion-proof electrical equipment and lighting.	
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION	Headache. Weakness. Nausea. Vomiting. Sweating. Confusion. Jaundice. Dark urine.	Ventilation (not if powder), local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves.	Rinse skin with plenty of water or shower.
•EYES		Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION	Abdominal pain. Diarrhoea. Convulsions. Unconsciousness. (Further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: filter respirator for organic gases and vapours. Do NOT let this chemical enter the environment. Sweep spilled substance into covered containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place.	Separated from strong oxidants, food and feedstuffs . Store in an area without drain or sewer access.	Do not transport with food and feedstuffs. Marine pollutant. Xn symbol N symbol R: 22-40-50/53 S: 2-36/37-46-60-61 UN Hazard Class: 4.1 UN Packing Group: III

ICSC: 0667	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0667

NAPHTHALENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE SOLID IN VARIOUS FORMS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
Dust explosion possible if in powder or granular form, mixed with air.

CHEMICAL DANGERS:
On combustion, forms irritating and toxic gases. Reacts with strong oxidants .

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 10 ppm as TWA; 15 ppm as STEL; (skin); A4 (not classifiable as a human carcinogen); (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 2; Germ cell mutagen group: 3B;
(DFG 2004).
OSHA PEL†: TWA 10 ppm (50 mg/m^3)
NIOSH REL: TWA 10 ppm (50 mg/m^3) ST 15 ppm (75 mg/m^3)
NIOSH IDLH: 250 ppm See: 91203

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C. See Notes.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the blood , resulting in lesions of blood cells (haemolysis) . See Notes. The effects may be delayed. Exposure by ingestion may result in death. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the blood , resulting in chronic haemolytic anaemia. The substance may have effects on the eyes , resulting in the development of cataract. This substance is possibly carcinogenic to humans.

PHYSICAL PROPERTIES	Boiling point: 218°C Sublimation slowly at room temperature Melting point: 80°C Density: 1.16 g/cm³ Solubility in water, g/100 ml at 25° C: none	Vapour pressure, Pa at 25°C: 11 Relative vapour density (air = 1): 4.42 Flash point: 80°C c.c. Auto-ignition temperature: 540°C Explosive limits, vol% in air: 0.9-5.9 Octanol/water partition coefficient as log Pow: 3.3
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment.	

N O T E S

Some individuals may be more sensitive to the effect of naphthalene on blood cells.
Transport Emergency Card: TEC (R)-41S1334 (solid); 41GF1-II+III (solid); 41S2304 (molten)

NFPA Code: H2; F2; R0;

ADDITIONAL INFORMATION

ICSC: 0667	**NAPHTHALENE**

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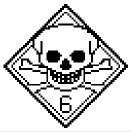
Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease
Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

NITROBENZENE

ICSC: 0065

$C_6H_5NO_2$ Molecular mass: 123.1 ICSC # 0065  	CAS # 98-95-3 RTECS # DA6475000 UN # 1662 EC # 609-003-00-7 April 06, 2006 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Water spray. Alcohol-resistant foam. Dry powder. Carbon dioxide.
EXPLOSION	Above 88°C explosive vapour/air mixtures may be formed. Risk of fire and explosion (see Chemical Dangers).	Above 88°C use a closed system, ventilation.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Headache. Blue lips or finger nails. Blue skin. Dizziness. Nausea. Weakness. Confusion. Convulsions. Unconsciousness.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Artificial respiration may be needed. Refer for medical attention.
•SKIN	MAY BE ABSORBED! (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention.

•EYES		Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	(see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Rest. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Personal protection: complete protective clothing including self-contained breathing apparatus. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment.	Separated from combustible and reducing substances, strong oxidants, strong acids, food and feedstuffs . Store in an area without drain or sewer access.	Do not transport with food and feedstuffs. T symbol N symbol R: 23/24/25-40-48/23/24-51/53-62 S: 1/2-28-36/37-45-61 UN Hazard Class: 6.1 UN Packing Group: II Signal: Danger Skull-Health haz Harmful if swallowed Toxic if inhaled vapour Toxic in contact with skin Suspected of causing cancer Suspected of damaging fertility or the unborn child May cause damage to blood cells Harmful to aquatic life with long lasting effects

ICSC: 0065	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0065

NITROBENZENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
PALE YELLOW OILY LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
On combustion, forms toxic and corrosive fumes including nitrogen oxides. Reacts violently with strong oxidants and reducing agents causing fire and explosion hazard. Reacts violently with strong acids and nitrogen oxides causing explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 1 ppm as TWA; (skin); A3 (confirmed animal carcinogen with unknown relevance to humans); BEI issued; (ACGIH 2005).
MAK: skin absorption (H); Carcinogen category: 3B; BAT issued;
(DFG 2006).
EU OEL: 1 mg/m^3, 0.2 ppm as TWA (skin) (EU 2006).
OSHA PEL: TWA 1 ppm (5 mg/m^3) skin
NIOSH REL: TWA 1 ppm (5 mg/m^3) skin
NIOSH IDLH: 200 ppm See: 98953

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation through the skin and by ingestion

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C; on spraying or dispersing, however, much faster.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance may cause effects on the blood , resulting in the formation of methaemoglobin. Exposure could cause lowering of consciousness. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the blood , spleen and liver . This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES	Boiling point: 211°C Melting point: 5°C Relative density (water = 1): 1.2 Solubility in water, g/100 ml: 0.2 Vapour pressure, Pa at 20°C: 20 Relative vapour density (air = 1): 4.2	Relative density of the vapour/air-mixture at 20°C (air = 1): 1.00 Flash point: 88°C c.c. Auto-ignition temperature: 480°C Explosive limits, vol% in air: 1.8-40 Octanol/water partition coefficient as log Pow: 1.86
ENVIRONMENTAL DATA	The substance is harmful to aquatic organisms. It is strongly advised that this substance does not enter the environment.	

NOTES

Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is suggested. Specific treatment is necessary in case of poisoning with this substance; the appropriate means with instructions must be available. Do NOT take working clothes home. Card has been partly updated in October 2006: see sections Occupational Exposure Limits.

Transport Emergency Card: TEC (R)-61S1662 or 61GT1-II
NFPA Code: H 3; F 2; R 1;
Card has been partially updated in January 2008: see GHS classification.

ADDITIONAL INFORMATION

ICSC: 0065 **NITROBENZENE**

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N-NITROSODIPHENYLAMINE

ICSC: 0526

Diphenylnitrosamine N-Nitroso-N-phenyl benzenamine N-nitroso-N-phenylaniline Nitrous diphenylamide $C_{12}H_{10}N_2O$ Molecular mass: 198.2 ICSC # 0526	CAS # 86-30-6 RTECS # JJ9800000 November 26, 2003 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames.	Foam , powder, carbon dioxide .
EXPLOSION			
EXPOSURE			
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN		Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES		Safety goggles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Rinse mouth. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Do NOT let this chemical enter the environment.	Separated from strong oxidants. Store in an area without drain or sewer access.	

ICSC: 0526	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0526

N-NITROSODIPHENYLAMINE

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** YELLOW FLAKES **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance decomposes on burning producing nitrogen oxides . Reacts vigorously with oxidants. **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established. MAK: Carcinogen category: 3B (DFG 2006).	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 101°C Melting point: 66.5°C Density: 1.23 g/cm^3	Solubility in water: none Octanol/water partition coefficient as log Pow: 2.57-3.13

ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms. Bioaccumulation of this chemical may occur in fish. It is strongly advised that this substance does not enter the environment.

N O T E S

Insufficient data are available on the effect of this substance on human health, therefore utmost care must be taken.

Card has been partially updated in August 2007: see Occupational Exposure Limits,

ADDITIONAL INFORMATION

ICSC: 0526 **N-NITROSODIPHENYLAMINE**

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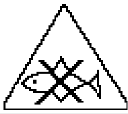
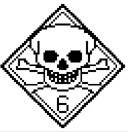
PENTACHLOROPHENOL

ICSC: 0069

C_6Cl_5OH Molecular mass: 266.4 ICSC # 0069 	CAS # 87-86-5 RTECS # SM6300000 UN # 3155 EC # 604-002-00-8 August 05, 2003 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible. Liquid formulations containing organic solvents may be flammable.		In case of fire in the surroundings: use appropriate extinguishing media.
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN! AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Cough. Dizziness. Drowsiness. Headache. Fever or elevated body temperature. Laboured breathing. Sore throat.	Local exhaust or breathing protection.	Fresh air, rest. Half-upright position. Artificial respiration may be needed. Refer for medical attention.

•SKIN	MAY BE ABSORBED! Redness. Blisters. (Further see Inhalation).	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse and then wash skin with water and soap. Refer for medical attention. Wear protective gloves when administering first aid.
•EYES	Redness. Pain.	Safety goggles, face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Abdominal cramps. Diarrhoea. Nausea. Unconsciousness. Vomiting. Weakness. (Further see Inhalation).	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give a slurry of activated charcoal in water to drink. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment. Complete protective clothing. (Extra personal protection: P3 filter respirator for toxic particles.)	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, food and feedstuffs . Keep in a well-ventilated room.	Do not transport with food and feedstuffs. Severe marine pollutant. T+ symbol N symbol R: 24/25-26-36/37/38-40-50/53 S: 1/2-22-36/37-45-52-60-61 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0069	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0069

PENTACHLOROPHENOL

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
WHITE CRYSTALS OR SOLID IN VARIOUS FORMS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
The substance decomposes on heating above 200°C, producing toxic and corrosive fumes including dioxins . Reacts violently with strong oxidants .

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.5 mg/m^3 as TWA; (skin); A3; BEI issued; (ACGIH 2003).
MAK: H;
Carcinogen category: 2;
(DFG 2002).
OSHA PEL: TWA 0.5 mg/m^3 skin
NIOSH REL: TWA 0.5 mg/m^3 skin
NIOSH IDLH: 2.5 mg/m^3 See: 87865

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes , the skin and the respiratory tract . The substance may cause effects on the cardiovascular system , resulting in cardiac disorders and heart failure.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The substance may have effects on the central nervous system , kidneys , liver , lungs , immune system , thyroid . This substance is possibly carcinogenic to humans. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES	Boiling point (decomposes): 309°C Melting point: 191°C Density: 1.98 Solubility in water, g/100 ml at 20°C: 0.001	Vapour pressure, Pa at 20°C: 0.02 Relative vapour density (air = 1): 9.2 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.00 Octanol/water partition coefficient as log Pow: 5.01
ENVIRONMENTAL DATA	The substance is very toxic to aquatic organisms. The substance may cause long-term effects in the aquatic environment. This substance does enter the environment under normal use. Great care, however, should be given to avoid any additional release, e.g. through inappropriate disposal.	

NOTES

The commercial product may contain very toxic impurities (dioxins). The odour warning when the exposure limit value is exceeded is insufficient.

Transport Emergency Card: TEC (R)-61GT2-II

NFPA Code: H 3; F 0; R 0;

ADDITIONAL INFORMATION

ICSC: 0069 **PENTACHLOROPHENOL**

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

New Jersey Department of Health

Right to Know
Hazardous Substance Fact Sheet

Common Name: **PHENANTHRENE**

Synonyms: Phenantrin; Coal Tar Pitch Volatiles

Chemical Name: Phenanthrene

Date: August 1999 Revision: November 2010

CAS Number: 85-01-8

RTK Substance Number: 3004

DOT Number: UN 3077

Description and Use

Phenanthrene is a colorless to white, crystalline (sand-like) solid with a faint odor. It is used in dyestuffs, explosives, research, and in making drugs. It is also a product of the incomplete combustion of wood and fossil fuels, and is found in polluted air and water.

Reasons for Citation

- **Phenanthrene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

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

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water. Seek medical attention.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	-
FLAMMABILITY	1	-
REACTIVITY	0	-
POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **Phenanthrene** can affect you when inhaled.
- Contact can irritate the skin and eyes. If skin contaminated with **Phenanthrene** is exposed to sunlight a rash or skin burn may occur, sometimes with blisters.
- Inhaling **Phenanthrene** can irritate the nose and throat.
- **Phenanthrene** may cause a skin allergy.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheet on COAL TAR PITCH.*

Workplace Exposure Limits

The following exposure limits are for *Coal Tar Pitch Volatiles*:

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

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as the *Cylohexane extractable fraction*) averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **0.2 mg/m^3** (as the *Benzene soluble aerosol*) averaged over an 8-hour workshift.

Determining Your Exposure

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

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

Health Hazard Information

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

- Contact can irritate the skin and eyes. If skin contaminated with **Phenanthrene** is exposed to sunlight a rash or skin burn may occur, sometimes with blisters.
- Inhaling **Phenanthrene** can irritate the nose and throat.

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

Cancer Hazard
- While **Phenanthrene** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- According to the information presently available to the New Jersey Department of Health, **Phenanthrene** has not been tested for its ability to affect reproduction.

Other Effects
- **Phenanthrene** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.

Medical

Medical Testing
If symptoms develop or overexposure is suspected, the following is recommended:

- Evaluation by a qualified allergist can help diagnose skin allergy.

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

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

Workplace Controls and Practices

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

The following work practices are also recommended:

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

In addition, the following may be useful or required:

- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Phenanthrene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials are Nitrile, Neoprene and Barrier® for *Coal Tar Extract*.
- The recommended protective clothing material for *solid* **Phenanthrene** is Tyvek®, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

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

- Where the potential exists for exposure over **0.1 mg/m^3**, use a NIOSH approved respirator with an organic vapor cartridge and particulate N, R or P100 prefilters. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Phenanthrene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **1 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.

Fire Hazards

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

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

Spills and Emergencies

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

If **Phenanthrene** is spilled, take the following steps:

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

Handling and Storage

Prior to working with **Phenanthrene** you should be trained on its proper handling and storage.

- **Phenanthrene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area away from HEAT and LIGHT.
- Sources of ignition, such as smoking and open flames, are prohibited where **Phenanthrene** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **PHENANTHRENE**

Synonyms: Phenantrin; Coal Tar Pitch Volatiles
CAS No: 85-01-8
Molecular Formula: $C_{14}H_{10}$
RTK Substance No: 3004
Description: Colorless to white, crystalline solid with a faint odor, also present as a by-product of incomplete combustion of wood and fossil fuels

HAZARD DATA

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

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.

DO NOT wash into sewer.

Phenanthrene is an environmental hazard and very toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Aromatic odor
Flash Point:	340°F (171°C)
Vapor Density:	6.14 (air = 1)
Vapor Pressure:	1 mm Hg at 245°F (118.3°C)
Specific Gravity:	1.1 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	642°F (339°C)
Melting Point:	212°F (100°C)
Molecular Weight:	178.23

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA
NIOSH:	0.1 mg/m^3, 10-hr TWA
ACGIH:	0.2 mg/m^3, 8-hr TWA
IDLH:	80 mg/m^3

(All the above are for *Coal Tar Pitch Volatiles*)

The Protective Action Criteria values are:
PAC-1 = 6 mg/m^3 PAC-2 = 40 mg/m^3
PAC-3 = 500 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile, Neoprene and Barrier® (>1-hr breakthrough for *Coal Tar Extract*)
Coveralls:	Tyvek®
Respirator:	>0.1 mg/m^3 - full facepiece APR with *Organic vapor* and *P100 cartridges* >1 mg/m^3 - SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose and throat irritation

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

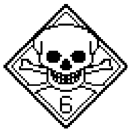
November 2010

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership
to Prevent Workplace Illnesses and Injuries

PHENOL

ICSC: 0070

Carbolic acid Phenic acid Hydroxybenzene C_6H_6O / C_6H_5OH Molecular mass: 94.1 ICSC # 0070 	CAS # 108-95-2 RTECS # SJ3325000 UN # 1671 EC # 604-001-00-2 October 15, 2001 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible.	NO open flames. NO contact with strong oxidants.	Alcohol-resistant foam, powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 79°C explosive vapour/air mixtures may be formed.	Above 79°C use a closed system, ventilation.	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		AVOID ALL CONTACT!	IN ALL CASES CONSULT A DOCTOR!
•INHALATION	Sore throat. Burning sensation. Cough. Dizziness. Headache. Nausea. Vomiting. Shortness of breath. Laboured breathing. Unconsciousness. Symptoms may be delayed (see Notes).	Avoid inhalation of fine dust and mist. Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Half-upright position. Refer for medical attention.

•SKIN	EASILY ABSORBED. Serious skin burns. Numbness. Convulsion. Collapse. Coma. Death.	Protective gloves. Protective clothing.	Remove contaminated clothes. Rinse skin with plenty of water or shower. To remove substance use polyethylene glycol 300 or vegetable oil. Refer for medical attention. Wear protective gloves when administering first aid.
•EYES	Pain. Redness. Permanent loss of vision. Severe deep burns.	Face shield, or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Corrosive. Abdominal pain. Convulsions. Diarrhoea. Shock or collapse. Sore throat. Smoky, greenish-dark urine.	Do not eat, drink, or smoke during work. Wash hands before eating.	Rinse mouth. Give plenty of water to drink. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into sealable containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: complete protective clothing including self-contained breathing apparatus. Do NOT let this chemical enter the environment.	Provision to contain effluent from fire extinguishing. Separated from strong oxidants, food and feedstuffs . Dry. Well closed. Keep in a well-ventilated room.	Do not transport with food and feedstuffs. T symbol C symbol R: 23/24/25-34-48/20/21/22-68 S: 1/2-24/25-26-28-36/37/39-45 UN Hazard Class: 6.1 UN Packing Group: II

ICSC: 0070	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0070

PHENOL

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS TO YELLOW OR LIGHT PINK CRYSTALS , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. The solution in water is a weak acid. Reacts with oxidants causing fire and explosion hazard.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 5 ppm as TWA; (skin); A4; BEI issued; (ACGIH 2004).
MAK: H;
Carcinogen category: 3B; (DFG 2004).
OSHA PEL: TWA 5 ppm (19 mg/m^3) skin
NIOSH REL: TWA 5 ppm (19 mg/m^3) C 15.6 ppm (60 mg/m^3) 15-minute skin
NIOSH IDLH: 250 ppm See: 108952

ROUTES OF EXPOSURE:
The substance can be absorbed into the body rapidly by inhalation of its vapour, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance and the vapour is corrosive to the eyes, the skin and the respiratory tract. Inhalation of vapour may cause lung oedema (see Notes). The substance may cause effects on the central nervous system , heart and kidneys , resulting in convulsions, coma, cardiac disordersrespiratory failure, collapse. Exposure may result in death. The effects may be delayed. Medical observation is indicated.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the liver and kidneys .

PHYSICAL PROPERTIES	Boiling point: 182°C Melting point: 43°C Density: 1.06 g/cm^3 Solubility in water: moderate Vapour pressure, Pa at 20°C: 47	Relative vapour density (air = 1): 3.2 Relative density of the vapour/air-mixture at 20°C (air = 1): 1.001 Flash point: 79°C c.c. Auto-ignition temperature: 715°C Explosive limits, vol% in air: 1.36-10 Octanol/water partition coefficient as log Pow: 1.46
ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms.	

NOTES

Other UN numbers: 2312 (molten); 2821 (solution). Use of alcoholic beverages enhances the harmful effect. Depending on the degree of exposure, periodic medical examination is suggested. The symptoms of lung oedema often do not become manifest until a few hours have passed and they are aggravated by physical effort. Rest and medical observation are therefore essential. Immediate administration of an appropriate inhalation therapy by a doctor or a person authorized by him/her, should be considered. Card has been partly updated in October 2004. See sections Occupational Exposure Limits, EU classification, Emergency Response.

Transport Emergency Card: TEC (R)-61S1671

NFPA Code: H 3; F 2; R 0;

ADDITIONAL INFORMATION

ICSC: 0070 **PHENOL**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

New Jersey Department of Health and Senior Services

HAZARDOUS SUBSTANCE FACT SHEET

Common Name: **PHOSPHORUS**

CAS Number: 7723-14-0
DOT Number: UN 1338 (amorphous, red)
UN 1381 (white or yellow, dry or under water)
UN 2447 (white, molten)

RTK Substance number: 1520
Date: June 1986/Sept. 1988 Revision: October 2002

HAZARD SUMMARY

- **Phosphorus** can affect you when breathed in.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Breathing **Phosphorus** can irritate the nose and throat causing coughing and wheezing.
- Repeated high exposure may affect the liver and kidneys.
- *White* or *yellow* **Phosphorus** is HIGHLY FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.

IDENTIFICATION

Phosphorus is a brick red, white or yellow, odorless, powder or solid. It is used in the manufacture of matches, **Phosphorus** *compounds*, fireworks, fertilizers, pesticides, electroluminescent coatings, and semiconductors.

REASON FOR CITATION

- **Phosphorus** is on the Hazardous Substance List because it is regulated by OSHA and cited by ACGIH, DOT, NIOSH, DEP, NFPA and EPA.
- *White* or *yellow* **Phosphorus** is on the Special Health Hazard Substance List because it is **FLAMMABLE** and **REACTIVE**.
- Definitions are provided on page 5.

HOW TO DETERMINE IF YOU ARE BEING EXPOSED

The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information and training concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard, 1910.1200, requires private employers to provide similar training and information to their employees.

- Exposure to hazardous substances should be routinely evaluated. This may include collecting personal and area air samples. You can obtain copies of sampling results from your employer. You have a legal right to this information under OSHA 1910.1020.
- If you think you are experiencing any work-related health problems, see a doctor trained to recognize occupational diseases. Take this Fact Sheet with you.

WORKPLACE EXPOSURE LIMITS

OSHA: The legal airborne permissible exposure limit (PEL) is **0.1 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit is **0.1 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The recommended airborne exposure limit is **0.01 mg/m^3** averaged over an 8-hour workshift.

WAYS OF REDUCING EXPOSURE

- Where possible, enclose operations and use local exhaust ventilation at the site of chemical release. If local exhaust ventilation or enclosure is not used, respirators should be worn.
- Wear protective work clothing.
- Wash thoroughly immediately after exposure to **Phosphorus** and at the end of the workshift.
- Post hazard and warning information in the work area. In addition, as part of an ongoing education and training effort, communicate all information on the health and safety hazards of **Phosphorus** to potentially exposed workers.

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

HEALTH HAZARD INFORMATION

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Phosphorus**:

* Contact can irritate and burn the skin and eyes with possible eye damage.
* Breathing **Phosphorus** can irritate the nose and throat causing coughing and wheezing.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Phosphorus** and can last for months or years:

Cancer Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Phosphorus** has not been tested for its ability to cause cancer in animals.

Reproductive Hazard

* According to the information presently available to the New Jersey Department of Health and Senior Services, **Phosphorus** has not been tested for its ability to affect reproduction.

Other Long-Term Effects

* Repeated high exposure may affect the liver and kidneys.

MEDICAL

Medical Testing

If symptoms develop or overexposure is suspected, the following are recommended:

* Liver and kidney function tests.

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

Request copies of your medical testing. You have a legal right to this information under OSHA 1910.1020.

Mixed Exposures

* Because more than light alcohol consumption can cause liver damage, drinking alcohol may increase the liver damage caused by **Phosphorus**.

WORKPLACE CONTROLS AND PRACTICES

Unless a less toxic chemical can be substituted for a hazardous substance, **ENGINEERING CONTROLS** are the most effective way of reducing exposure. The best protection is to enclose operations and/or provide local exhaust ventilation at the site of chemical release. Isolating operations can also reduce exposure. Using respirators or protective equipment is less effective than the controls mentioned above, but is sometimes necessary.

In evaluating the controls present in your workplace, consider: (1) how hazardous the substance is, (2) how much of the substance is released into the workplace and (3) whether harmful skin or eye contact could occur. Special controls should be in place for highly toxic chemicals or when significant skin, eye, or breathing exposures are possible.

In addition, the following controls are recommended:

* Where possible, automatically transfer **Phosphorus** from drums or other storage containers to process containers.
* Before entering a confined space where *white* or *yellow* **Phosphorus** may be present, check to make sure that an explosive concentration does not exist.

Good **WORK PRACTICES** can help to reduce hazardous exposures. The following work practices are recommended:

* Workers whose clothing has been contaminated by **Phosphorus** should change into clean clothing promptly.
* Do not take contaminated work clothes home. Family members could be exposed.
* Contaminated work clothes should be laundered by individuals who have been informed of the hazards of exposure to **Phosphorus**.
* Eye wash fountains should be provided in the immediate work area for emergency use.
* If there is the possibility of skin exposure, emergency shower facilities should be provided.
* On skin contact with **Phosphorus**, immediately wash or shower to remove the chemical. At the end of the workshift, wash any areas of the body that may have contacted **Phosphorus**, whether or not known skin contact has occurred.
* Do not eat, smoke, or drink where **Phosphorus** is handled, processed, or stored, since the chemical can be swallowed. Wash hands carefully before eating, drinking, smoking, or using the toilet.
* Use a vacuum to reduce dust during clean-up. DO NOT DRY SWEEP.

PERSONAL PROTECTIVE EQUIPMENT

WORKPLACE CONTROLS ARE BETTER THAN PERSONAL PROTECTIVE EQUIPMENT. However, for some jobs (such as outside work, confined space entry, jobs done only once in a while, or jobs done while workplace controls are being installed), personal protective equipment may be appropriate.

OSHA 1910.132 requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

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

Clothing

* Avoid skin contact with **Phosphorus**. Wear protective gloves and clothing. Safety equipment suppliers/ manufacturers can provide recommendations on the most protective glove/clothing material for your operation.

* All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

* Wear impact resistant eye protection with side shields or goggles.

* Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

* Contact lenses should not be worn when working with this substance.

Respiratory Protection

IMPROPER USE OF RESPIRATORS IS DANGEROUS. Such equipment should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing and medical exams, as described in OSHA 1910.134.

* NIOSH has established new testing and certification requirements for negative pressure, air purifying, particulate filter and filtering facepiece respirators. The filter classifications of dust/mist/fume, paint spray or pesticide prefilters, and filters for radon daughters, have been replaced with the N, R, and P series. Each series has three levels of filtering efficiency: 95%, 99%, and 99.9%. Check with your safety equipment supplier or your respirator manufacturer to determine which respirator is appropriate for your facility.

* If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Phosphorus**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.

* Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.

* Where the potential exists for exposure over **1 mg/m^3**, use a MSHA/NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

* Exposure to **5 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5 mg/m^3** exists, use a MSHA/NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode.

HANDLING AND STORAGE

* Prior to working with **Phosphorus** you should be trained on its proper handling and storage.

* *White* or *yellow* **Phosphorus** ignites spontaneously in AIR.

* *White* or *yellow* **Phosphorus** may explode on contact with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).

* **Phosphorus** is not compatible with HALOGENS; HALIDES; SULFUR; COPPER; MAGNESIUM; COMBUSTIBLES; BARIUM; ZINC; SODIUM; POTASSIUM; and STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE).

* Store in tightly closed containers in a cool, well-ventilated area away from HEAT and DIRECT SUNLIGHT.

* Sources of ignition, such as smoking and open flames, are prohibited where *white* or *yellow* **Phosphorus** is used, handled, or stored.

* Metal containers involving the transfer of *white* or *yellow* **Phosphorus** should be grounded and bonded.

* Use only non-sparking tools and equipment, especially when opening and closing containers of *white* or *yellow* **Phosphorus**.

* Wherever *white* or *yellow* **Phosphorus** is used, handled, manufactured, or stored, use explosion-proof electrical equipment and fittings.

QUESTIONS AND ANSWERS

Q: If I have acute health effects, will I later get chronic health effects?

A: Not always. Most chronic (long-term) effects result from repeated exposures to a chemical.

Q: Can I get long-term effects without ever having short-term effects?

A: Yes, because long-term effects can occur from repeated exposures to a chemical at levels not high enough to make you immediately sick.

Q: What are my chances of getting sick when I have been exposed to chemicals?

A: The likelihood of becoming sick from chemicals is increased as the amount of exposure increases. This is determined by the length of time and the amount of material to which someone is exposed.

Q: When are higher exposures more likely?

A: Conditions which increase risk of exposure include dust releasing operations (grinding, mixing, blasting, dumping, etc.), other physical and mechanical processes (heating, pouring, spraying, spills and evaporation from large surface areas such as open containers), and "confined space" exposures (working inside vats, reactors, boilers, small rooms, etc.).

Q: Is the risk of getting sick higher for workers than for community residents?

A: Yes. Exposures in the community, except possibly in cases of fires or spills, are usually much lower than those found in the workplace. However, people in the community may be exposed to contaminated water as well as to chemicals in the air over long periods. This may be a problem for children or people who are already ill.

The following information is available from:

New Jersey Department of Health and Senior Services
Occupational Health Service
PO Box 360
Trenton, NJ 08625-0360
(609) 984-1863
(609) 984-7407 (fax)

Web address: http://www.state.nj.us/health/eoh/odisweb/

Industrial Hygiene Information

Industrial hygienists are available to answer your questions regarding the control of chemical exposures using exhaust ventilation, special work practices, good housekeeping, good hygiene practices, and personal protective equipment including respirators. In addition, they can help to interpret the results of industrial hygiene survey data.

Medical Evaluation

If you think you are becoming sick because of exposure to chemicals at your workplace, you may call personnel at the Department of Health and Senior Services, Occupational Health Service, who can help you find the information you need.

Public Presentations

Presentations and educational programs on occupational health or the Right to Know Act can be organized for labor unions, trade associations and other groups.

Right to Know Information Resources

The Right to Know Infoline (609) 984-2202 can answer questions about the identity and potential health effects of chemicals, list of educational materials in occupational health, references used to prepare the Fact Sheets, preparation of the Right to Know Survey, education and training programs, labeling requirements, and general information regarding the Right to Know Act. Violations of the law should be reported to (609) 984-2202.

DEFINITIONS

ACGIH is the American Conference of Governmental Industrial Hygienists. It recommends upper limits (called TLVs) for exposure to workplace chemicals.

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

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

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

A **corrosive** substance is a gas, liquid or solid that causes irreversible damage to human tissue or containers.

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

HHAG is the Human Health Assessment Group of the federal EPA.

IARC is the International Agency for Research on Cancer, a scientific group that classifies chemicals according to their cancer-causing potential.

A **miscible** substance is a liquid or gas that will evenly dissolve in another.

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

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

NAERG is the North American Emergency Response Guidebook. It was jointly developed by Transport Canada, the United States Department of Transportation and the Secretariat of Communications and Transportation of Mexico. It is a guide for first responders to quickly identify the specific or generic hazards of material involved in a transportation incident, and to protect themselves and the general public during the initial response phase of the incident.

NCI is the National Cancer Institute, a federal agency that determines the cancer-causing potential of chemicals.

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

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

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

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

PEL is the Permissible Exposure Limit which is enforceable by the Occupational Safety and Health Administration.

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

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

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

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

TLV is the Threshold Limit Value, the workplace exposure limit recommended by ACGIH.

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

>>>>>>>>>>>>>>>>> EMERGENCY INFORMATION <<<<<<<<<<<<<<<<<

Common Name: **PHOSPHORUS**
DOT Number: **UN 1338 (amorphous, red)**
UN 1381 (white or yellow, dry or under water)
UN 2447 (white, molten)
NAERG Code: **133 (red)**
136 (white or yellow, dry, molten, under water)
CAS Number: **7723-14-0**

Hazard rating	NJDHSS	NFPA
FLAMMABILITY	-	1, 4**
REACTIVITY	-	1, 2**
**FLAMMABLE AND REACTIVE (WHITE OR YELLOW MOLTEN, DRY OR UNDER WATER) COMBUSTIBLE (AMORPHOUS, RED) MAY IGNITE SPONTANEOUSLY IN AIR POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

FIRE HAZARDS

* **Phosphorus** *white* or *yellow*, *dry*, *molten* or *under water* are FLAMMABLE SOLIDS.
* **Phosphorus** *amorphous*, *red* is a COMBUSTIBLE SOLID.
* Flood with water to control flames, then smother with wet sand, clay or ground limestone.
* **PHOSPHORUS** MAY IGNITE SPONTANEOUSLY IN AIR.
* POISONOUS GASES ARE PRODUCED IN FIRE, including *Phosphine*.
* CONTAINERS MAY EXPLODE IN FIRE.
* Use water spray to keep fire-exposed containers cool.
* FIRE MAY RESTART AFTER IT HAS BEEN EXTINGUISHED.
* **Phosphorus** may ignite combustibles (wood, paper and oil).
* If employees are expected to fight fires, they must be trained and equipped as stated in OSHA 1910.156.

SPILLS AND EMERGENCIES

If **Phosphorus** is spilled or leaked, take the following steps:

* Evacuate persons not wearing protective equipment from area of spill or leak until clean-up is complete.
* Remove all ignition sources.
* Cover with dry lime, sand or soda ash, and place in covered containers for disposal.
* DO NOT USE WATER OR WET METHOD.
* Ventilate and wash area after clean-up is complete.
* Keep **Phosphorus** out of a confined space, such as a sewer, because of the possibility of an explosion, unless the sewer is designed to prevent the build-up of explosive concentrations.
* It may be necessary to contain and dispose of **Phosphorus** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.
* If employees are required to clean-up spills, they must be properly trained and equipped. OSHA 1910.120(q) may be applicable.

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FOR LARGE SPILLS AND FIRES immediately call your fire department. You can request emergency information from the following:

CHEMTREC: (800) 424-9300
NJDEP HOTLINE: 1-877-WARN-DEP

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HANDLING AND STORAGE (See page 3)

FIRST AID

For POISON INFORMATION call 1-800-222-1222

Eye Contact

* Immediately flush with large amounts of water for at least 15 minutes, occasionally lifting upper and lower lids. Seek medical attention.

Skin Contact

* Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Breathing

* Remove the person from exposure.
* Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
* Transfer promptly to a medical facility.

PHYSICAL DATA

Vapor Pressure: 0.03 mm Hg at 68°F (20°C)
Flash Point: 86°F (30°C) (autoignition temperature)
Water Solubility: Insoluble

OTHER COMMONLY USED NAMES

Chemical Name:

Phosphorus

Other Names:

Red Phosphorus; WP; Yellow Phosphorus; Phosphorus, White, Molten

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Not intended to be copied and sold for commercial purposes.

NEW JERSEY DEPARTMENT OF HEALTH AND
SENIOR SERVICES
Right to Know Program
PO Box 368, Trenton, NJ 08625-0368
(609) 984-2202

Right to Know

Hazardous Substance Fact Sheet

Common Name: **POLYCHLORINATED BIPHENYLS**

Synonyms: Aroclor; Chlorodiphenyls; PCBs
Chemical Name: 1,1'-Biphenyl, Chloro Derivs.
Date: April 2002 Revision: November 2008

CAS Number: 1336-36-3
RTK Substance Number: 1554
DOT Number: UN 2315

Description and Use

Polychlorinated Biphenyls are light yellow or colorless, thick, oily liquids. They are used in hydraulic and heat transfer liquids. They were formally used in electrical capacitors and transformers.

Reasons for Citation

- **Polychlorinated Biphenyls** are on the Right to Know Hazardous Substance List because they are cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

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

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	2
FLAMMABILITY	-	1
REACTIVITY	-	0
CARCINOGEN TERATOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

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

- **Polychlorinated Biphenyls** can affect you when inhaled and by passing through the skin.
- **Polychlorinated Biphenyls** should be handled as CARCINOGENS and may be TERATOGENS. HANDLE WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- **Polychlorinated Biphenyls** may cause brownish pigmentation of the skin, eyes and fingernails.
- Skin contact may cause an acne-like rash (chloracne).
- Inhaling the vapors can irritate the nose, throat and lungs.
- Exposure to **Polychlorinated Biphenyls** can cause headache, nausea, vomiting, loss of weight and abdominal pain.
- High exposure can damage the nervous system causing headache, numbness, weakness, and tingling ("pins and needles) in the arms and legs.
- **Polychlorinated Biphenyls** may damage the liver.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 mg/m^3** (42% *Chlorine*) and **0.5 mg/m^3** (54% *Chlorine*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.001 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **1 mg/m^3** (42% *Chlorine*) and **0.5 mg/m^3** (54% *Chlorine*) averaged over an 8-hour workshift.

- **Polychlorinated Biphenyls** are PROBABLE CARCINOGENS and TERATOGENS in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

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

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

Health Hazard Information

Acute Health Effects

The following acute (short-term) health effects may occur immediately or shortly after exposure to **Polychlorinated Biphenyls**:

- Contact can irritate the skin and eyes.
- Inhaling the vapors can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- Exposure to **Polychlorinated Biphenyls** can cause headache, nausea, vomiting, loss of weight and abdominal pain.

Chronic Health Effects

The following chronic (long-term) health effects can occur at some time after exposure to **Polychlorinated Biphenyls** and can last for months or years:

Cancer Hazard

- **Polychlorinated Biphenyls** are PROBABLE CARCINOGENS in humans. There is evidence that they cause cancer of the skin, brain, and pancreas in humans and have been shown to cause liver and pituitary cancer, and leukemia, in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard

- **Polychlorinated Biphenyls** may be TERATOGENS in humans since they are teratogens in animals.
- There is limited evidence that **Polychlorinated Biphenyls** may affect male and female fertility.

Other Effects

- **Polychlorinated Biphenyls** may cause brownish pigmentation of the skin, eyes and fingernails.
- Skin contact may cause an acne-like rash (chloracne).
- High exposure can damage the nervous system causing headache, numbness, weakness, and tingling ("pins and needles) in the arms and legs.
- **Polychlorinated Biphenyls** may damage the liver.

Medical

Medical Testing

Before beginning employment and at regular times after that, for frequent or potentially high exposures, the following are recommended:

- Liver function tests
- Exam of the skin and fingernails

If symptoms develop or overexposure is suspected, the following are recommended:

- Blood PCB levels
- Exam of the nervous system

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

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

Mixed Exposures

- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Polychlorinated Biphenyls**.

Workplace Controls and Practices

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

The following work practices are also recommended:

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

In addition, the following may be useful or required:

- Where possible, transfer **Polychlorinated Biphenyls** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

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

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

Gloves and Clothing

- Avoid skin contact with **Polychlorinated Biphenyls**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton for gloves, and Tychem® CPF 2, SL, CPF 4 and Responder®, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

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

- Where the potential exists for exposure over **0.001 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **5 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

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

- **Polychlorinated Biphenyls** may burn, but do not readily ignite.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Polychlorinated Dibenzofurans* and *Chlorinated Dibenzo-p-dioxins*.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

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

If **Polychlorinated Biphenyls** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Polychlorinated Biphenyls** as HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Polychlorinated Biphenyls** you should be trained on its proper handling and storage.

- **Polychlorinated Biphenyls** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area away from STRONG ULTRAVIOLET LIGHT and SUNLIGHT.

Occupational Health Information Resources

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

For more information, please contact:

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

The Right to Know Hazardous Substance Fact Sheets are not intended to be copied and sold for commercial purposes.

GLOSSARY

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

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

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

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

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

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

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

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

DEP is the New Jersey Department of Environmental Protection.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

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

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

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

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

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

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Emergency Responders Quick Reference

Right to Know Hazardous Substance Fact Sheet

Common Name: **POLYCHLORINATED BIPHENYLS**

Synonyms: Aroclor; Chlorodiphenyls; PCBs
CAS No: 1336-36-3
Molecular Formula: $C_{12}H_{10-n}Cl_n$
RTK Substance No: 1554

Description: Light yellow or colorless, thick, oily liquids

HAZARD DATA

Hazard Rating

3 - Health

1 - Fire

0 - Reactivity

DOT#: UN 2315

ERG Guide #: 171

Hazard Class: 9 (Miscellaneous Hazardous Materials)

Firefighting

Polychlorinated Biphenyls may burn, but do not readily ignite.

Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.

POISONOUS GASES ARE PRODUCED IN FIRE, including *Polychlorinated Dibenzofurans* and *Chlorinated Dibenzo-p-dioxins*.

Use water spray to keep fire-exposed containers cool.

Reactivity

Polychlorinated Biphenyls are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

SPILL/LEAKS

Isolation Distance:

Spills: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

Polychlorinated Biphenyls bioaccumulate and are hazardous to the environment.

PHYSICAL PROPERTIES

Flash Point:	286° to 385°F (141° to 196°C)
Auto Ignition Temp:	464°F (240°C)
Vapor Pressure:	0.001 mm Hg at 68°F (20°C)
Specific Gravity:	1.3 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	617° to 734°F (325° to 390°C)
Melting Point:	-2° to 50°F (-19° to 10°C)
Molecular Weight:	258 to 326

EXPOSURE LIMITS

OSHA:	1 mg/m^3, 8-hr TWA (42% *Chlorine*) and 0.5 mg/m^3, 8-hr TWA (54% *Chlorine*)
NIOSH:	0.001 mg/m^3, 10-hr TWA
ACGIH:	1 mg/m^3, 8-hr TWA (42% *Chlorine*) and 0.5 mg/m^3, 8-hr TWA (54% *Chlorine*)
IDLH:	5 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton (>4-hr breakthrough)
Coveralls:	Tychem® CPF 2, SL, CPF 4 and Responder® (>8-hr breakthrough)
Respirator:	>0.001 mg/m^3 - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath Headache, nausea, vomiting, and abdominal pain
Chronic:	Cancer (skin, brain, pancreas) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

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

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility

November 2008

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries

PYRENE

ICSC: 1474

Benzo (d,e,f) phenanthrene beta-Pyrene $C_{16}H_{10}$ Molecular mass: 202.26 ICSC # 1474	CAS # 129-00-0 RTECS # UR2450000 November 27, 2003 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames, NO sparks, and NO smoking.	Water spray, carbon dioxide, dry powder, alcohol-resistant foam, or polymer foam.
EXPLOSION			
EXPOSURE			
•INHALATION		Avoid inhalation of dust .	Fresh air, rest.
•SKIN	Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.
•EYES	Redness.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	Do NOT induce vomiting. Give plenty of water to drink. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder . Do NOT let this chemical enter the environment. (Extra personal protection: P2 filter respirator for harmful particles.)	Separated from strong oxidants. Keep in a well-ventilated room.	Do not transport with food and feedstuffs.
ICSC: 1474	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.	

ICSC: 1474

PYRENE

I M P O R T A N T D A T A	**PHYSICAL STATE; APPEARANCE:** PALE YELLOW OR COLOURLESS SOLID IN VARIOUS FORMS **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** The substance decomposes on heating producing irritating fumes . **OCCUPATIONAL EXPOSURE LIMITS:** TLV not established. MAK not established.	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation , through the skin and by ingestion . **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** Exposure to sun may provoke an irritating effect of pyrene on skin and lead to chronic skin discoloration. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:**
PHYSICAL PROPERTIES	Boiling point: 404°C Melting point: 151°C Density: 1.27 g/cm^3	Solubility in water: 0.135 mg/l at 25°C Vapour pressure, Pa at °C: 0.08 Octanol/water partition coefficient as log Pow: 4.88

ENVIRONMENTAL DATA	Bioaccumulation of this chemical may occur in crustacea,in fish,in milk,in algae andin molluscs. It is strongly advised that this substance does not enter the environment.

N O T E S

Pyrene is one of many polycyclic aromatic hydrocarbons - standards are usually established for them as mixtures, e.g., coal tar pitch volatiles. However, pyrene may be encountered as a laboratory chemical in its pure form. Health effects of exposure to the substance have not been investigated adequately. See ICSC 1415 Coal-tar pitch.

ADDITIONAL INFORMATION

ICSC: 1474 **PYRENE**

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries

SELENIUM

ICSC: 0072

Se (powder) ICSC # 0072	CAS # 7782-49-2 RTECS # VS7700000 EC # 034-001-00-2 April 26, 1993 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Combustible. Gives off irritating or toxic fumes (or gases) in a fire.	NO open flames. NO contact with oxidants.	Powder, AFFF, foam, carbon dioxide. NO water .
EXPLOSION	Risk of fire and explosion on contact with oxidants.		
EXPOSURE		PREVENT DISPERSION OF DUST! STRICT HYGIENE!	
•INHALATION	Irritation of nose. Cough. Dizziness. Headache. Laboured breathing. Nausea. Sore throat. Vomiting. Weakness. Symptoms may be delayed (see Notes).	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Redness. Skin burns. Pain. Discolouration.	Protective gloves. Protective clothing.	Rinse skin with plenty of water or shower. Refer for medical attention. Remove and isolate contaminated clothes.
•EYES	Redness. Pain. Blurred vision.	Safety spectacles or eye protection in combination with breathing protection.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.

•INGESTION	Metallic taste. Diarrhoea. Chills. Fever. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Induce vomiting (ONLY IN CONSCIOUS PERSONS!). Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Do NOT wash away into sewer. Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Personal protection: P3 filter respirator for toxic particles.	Fireproof. Separated from strong oxidants, strong acids, food and feedstuffs . Dry.	Airtight. Do not transport with food and feedstuffs. T symbol R: 23/25-33-53 S: 1/2-20/21-28-45-61

ICSC: 0072	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0072

SELENIUM

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
ODOURLESS SOLID IN VARIOUS FORMS. DARK RED-BROWN TO BLUISH-BLACK AMORPHOUS SOLID OR RED TRANSPARENT CRYSTALS OR METALLIC GREY TO BLACK CRYSTALS.

PHYSICAL DANGERS:

CHEMICAL DANGERS:
Upon heating, toxic fumes are formed. Reacts violently with oxidants strong acids . Reacts withwater at 50°C forming flammable/explosive gas (hydrogen - see ICSC0001) and selenious acids. Reacts with incandescence on gentle heating with phosphorous and metals such as nickel, zinc, sodium, potassium, platinum.

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 0.2 mg/m^3 as TWA; (ACGIH 2004).
MAK: (Inhalable fraction) 0.05 mg/m^3;
Peak limitation category: II(4);
Carcinogen category: 3B;
Pregnancy risk group: C;
(DFG 2004).
OSHA PEL*: TWA 0.2 mg/m^3
*Note: The PEL also applies to other selenium compounds (as Se) except Selenium hexafluoride.
NIOSH REL*: TWA 0.2 mg/m^3
*Note: The REL also applies to other selenium compounds (as Se) except Selenium hexafluoride.
NIOSH IDLH: 1 mg/m^3 (as Se) See: 7782492

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the respiratory tract . Inhalation of dust may cause lung oedema (see Notes). Inhalation of fume may cause symptoms of asphyxiation, chills and fever and bronchitis. The effects may be delayed.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
Repeated or prolonged contact with skin may cause dermatitis. The substance may have effects on the respiratory tract, gastrointestinal tract, and skin , resulting in nausea, vomiting, cough, yellowish skin discolouration, loss of nails, garlic breath and bad teeth.

PHYSICAL PROPERTIES	Boiling point: 685°C Melting point: 170-217°C Relative density (water = 1): 4.8	Solubility in water: none Vapour pressure, Pa at 20°C: 0.1
ENVIRONMENTAL DATA		

N O T E S

Do NOT take working clothes home. Card has been partly updated in April 2005. See sections Occupational Exposure Limits, EU classification, Emergency Response.

ADDITIONAL INFORMATION

ICSC: 0072 **SELENIUM**

IMPORTANT LEGAL NOTICE:	Neither NIOSH, the CEC or the IPCS nor any person acting on behalf of NIOSH, the CEC or the IPCS is responsible for the use which might be made of this information. This card contains the collective views of the IPCS Peer Review Committee and may not reflect in all cases all the detailed requirements included in national legislation on the subject. The user should verify compliance of the cards with the relevant legislation in the country of use. The only modifications made to produce the U.S. version is inclusion of the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

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Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries
NIOSH®

SILVER

ICSC: 0810

Argentium C.I. 77820 Ag ICSC # 0810	CAS # 7440-22-4 RTECS # VW3500000 September 10, 1997 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Not combustible, except as powder.		
EXPLOSION			
EXPOSURE		PREVENT DISPERSION OF DUST!	
•INHALATION		Local exhaust or breathing protection.	Fresh air, rest.
•SKIN		Protective gloves.	Rinse skin with plenty of water or shower.
•EYES		Safety spectacles, or eye protection in combination with breathing protection if powder.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION		Do not eat, drink, or smoke during work.	

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING

Sweep spilled substance into containers; if appropriate, moisten first to prevent dusting. Carefully collect remainder, then remove to safe place. Do NOT let this chemical enter the environment.	Separated from ammonia, strong hydrogen peroxide solutions, strong acids.	

ICSC: 0810	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0810

SILVER

IMPORTANT DATA	**PHYSICAL STATE; APPEARANCE:** WHITE METAL, TURNS DARK ON EXPOSURE TO OZONE, HYDROGEN SULFIDE OR SULFUR. **PHYSICAL DANGERS:** **CHEMICAL DANGERS:** Shock-sensitive compounds are formed with acetylene. Reacts with acids causing fire hazard. Contact with strong hydrogen peroxide solution will cause violent decomposition to oxygen gas. Contact with ammonia may cause formation of compounds that are explosive when dry. **OCCUPATIONAL EXPOSURE LIMITS:** TLV (metal): 0.1 mg/m^3 (ACGIH 1997). EU OEL: 0.1 mg/m^3 as TWA (EU 2000). OSHA PEL: TWA 0.01 mg/m^3 NIOSH REL: TWA 0.01 mg/m^3 NIOSH IDLH: 10 mg/m^3 (as Ag) See: IDLH INDEX	**ROUTES OF EXPOSURE:** The substance can be absorbed into the body by inhalation and by ingestion. **INHALATION RISK:** Evaporation at 20°C is negligible; a harmful concentration of airborne particles can, however, be reached quickly when dispersed. **EFFECTS OF SHORT-TERM EXPOSURE:** Inhalation of high amounts of metallic silver vapours may cause lung damage with pulmonary oedema. **EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:** The substance may cause a grey-blue discoloration of the eyes, nose, throat and skin (argyria/argyrosis).
PHYSICAL PROPERTIES	Boiling point: 2212°C Melting point: 962°C	Relative density (water = 1): 10.5 Solubility in water: none

ENVIRONMENTAL DATA	This substance may be hazardous to the environment; special attention should be given to aquatic organisms.

N O T E S

Card has been partially updated in March 2008: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0810 **SILVER**

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ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

☐ TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.

☐ TPH may be released directly into water through spills or leaks.

☐ Some TPH fractions will float on the water and form surface films.

☐ Other TPH fractions will sink to the bottom sediments.

☐ Bacteria and microorganisms in the water may break down some of the TPH fractions.

☐ Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

☐ Everyone is exposed to TPH from many sources.

☐ Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.

☐ Drinking water contaminated with TPH.

☐ Working in occupations that use petroleum products.

☐ Living in an area near a spill or leak of petroleum products.

☐ Touching soil contaminated with TPH.

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called "peripheral neuropathy," consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I've been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

6. HEALTH EFFECTS

6.1 INTRODUCTION

The primary purpose of this chapter is to provide public health officials, physicians, toxicologists, and other interested individuals and groups with an overall perspective on the toxicology of total petroleum hydrocarbons (TPH), and an understanding of various approaches used to assess petroleum hydrocarbons on the basis of fractions, individual indicator compounds, and appropriate surrogates. This chapter also provides descriptions and evaluations of toxicological studies and epidemiological investigations for these TPH fractions, indicator compounds, and surrogates, and provides conclusions, where possible, on the relevance of toxicity and toxicokinetics data to public health.

6.1.1 TPH Definition and Issues

Overview. The assessment of petroleum hydrocarbon-contaminated sites has involved analysis for "total petroleum hydrocarbons" or TPH. TPH is a loosely defined aggregate that depends on the method of analysis as well as the contaminating material, and represents the total mass of hydrocarbons without identification of individual components (see Chapter 3). As TPH is not a consistent entity, the assessment of health effects and development of health guidance values, such as Minimal Risk Levels (MRLs) for *TPH as a single entity* are problematic. Earlier in the profile (Chapters 2 and 3), various TPH approaches were presented that divide TPH into fractions or groups of compounds based on analytical, fate and transport, and exposure issues. Similarly, several different approaches have also been evolving to assess the health effects of TPH on the basis of indicator compounds for separate fractions, which consist of petroleum hydrocarbons with similar physical and chemical properties. ATSDR's approach to potential health effects from exposure to TPH uses surrogate health effects guidelines for each fraction, whether they represent an individual compound or a whole petroleum product. Additional discussions focusing on these various approaches to health effects assessment are presented in the remainder of this section (6.1). In particular, the ATSDR approach (Section 6.1.3) uses existing ATSDR MRLs for several individual TPH compounds and for specific petroleum products. The use of these MRLs to characterize the health effects of TPH, using an indicator compound and fraction/surrogate approach, is also discussed.

Scope of the Problem. Petroleum hydrocarbons are the principal components in a wide variety of commercial products (e.g., gasoline, fuel oils, lubricating oils, solvents, mineral spirits, mineral oils, and crude oil). Because of widespread use, disposal, and spills, environmental contamination is relatively common. It is important to understand that petroleum products are complex mixtures, typically containing hundreds of compounds. These include various amounts of aliphatic compounds (straight-chain, branched-chain, and cyclic alkanes and alkenes) and aromatic compounds (benzene and alkyl benzenes, naphthalenes, and PAHs). In addition, many petroleum products contain non-hydrocarbon additives such as alcohols, ethers, metals, and other chemicals that may affect the toxicity of the mixture.

The number of individual identified hydrocarbon components of the various petroleum products has been estimated at several hundred to over a thousand. Toxicity data are available for about 95 of these, but only about 25 were considered to have sufficient data to develop toxicity criteria according to the Total Petroleum Hydrocarbon Criteria Working Group (TPHCWG 1997b). ATSDR has derived MRLs for 12 of these compounds (anthracene, benzene, ethylbenzene, fluoranthene, fluorene, *n*-hexane, naphthalene, toluene, *m*-xylene, *p*-xylene, xylenes, and l-methyl naphthalene). EPA has derived Reference Doses (RfDs) and Reference Concentrations (RfCs) for some of the remaining compounds. The TPHCWG (1997c) and the Massachusetts Department of Environmental Protection (MADEP) (Hutcheson et al. 1996) have also derived other health guidance criteria for some of these compounds. Two of these compounds have EPA-derived cancer slope factors and/or unit risks, and a relative potency approach has been developed for some of the PAHs. However, it is not yet possible to assess the overall health implications of TPH from the individual hydrocarbon components because many of the known components lack appropriate, standardized, comparable toxicity data. In addition the cost of analysis for all TPH constituents is usually prohibitive.

Although health effects data are available for some petroleum products, and ATSDR-derived MRLs are available for fuel oil no. 2, JP-4, JP-5/JP-8, JP-7, and kerosene, there are limitations to applying MRLs for the whole products to TPH. A major limitation is that, when released to the environment, the composition of a petroleum product changes due to weathering (i.e., differential fate and transport of its components). Partitioning of fractions consisting of hydrocarbons with similar physical and chemical properties occurs, with migration of some fractions to other locations and environmental media, leaving the relatively nonmobile components (the weathered product) at the original location.

Thus, the actual petroleum hydrocarbon mixture to which a given population is exposed varies with location, time and environmental medium. Accordingly, health effects data for whole petroleum products that are relatively heterogeneous, such as gasoline and JP-4, are not necessarily applicable to the fractions to which exposure actually occurs as a result of transport and weathering. For example, acute inhalation exposure to a fresh spill of gasoline will be to the more volatile constituents, whereas intermediate or chronic oral exposure to drinking water contaminated by a gasoline release will be to the soluble constituents, and exposure to soil at the site of the original spill will be to the less volatile and less soluble constituents. Thus, none of these exposure scenarios would be well represented by experimental data using the whole product.

Additional limitations to the use of health effects data for whole petroleum products include the variable composition of each type of petroleum product due to differences in the crude oil from which it was refined, in the refining processes used, and in the formulation of the final product. Also, non-hydrocarbon additives and contaminants, many of which have significant toxicity, are often included in these whole products (e.g., methyl-*tert*-butyl ether (MTBE) or lead in gasoline). Finally, the identity of the originally released material may not be known or more than one such product may have been released.

Health effects data also are available for some petroleum fractions or process streams that are less heterogeneous. These materials are more representative of the fractions that may partition in the environment and are more useful for assessing health effects of intermediate and chronic exposure to petroleum hydrocarbons. These products are discussed further in Section 6.2. Additional discussion of these and also the more heterogeneous products is presented in Section 6.3.

Mixtures Issues. Petroleum products and their environmental transport fractions are complex mixtures. The preferred method for assessing the health effects of complex mixtures is to use exposure and toxicity data for the mixture of concern, because this approach takes into account toxicological interactions, such as synergism or antagonism, that may occur among the constituents of the mixture. If data for the mixture of concern are not available, then data for a similar mixture may be used. In the absence of pertinent data for the same or a similar mixture, data on the individual components of the mixture are used, taking into account the potential for toxicological interactions. The default assumption, when data regarding interactions are not available or do not clearly indicate the direction of the interaction, is that the doses or effects are additive (ATSDR 1992; De Rosa et al. 1996; EPA 1986; Johnson and De Rosa 1995; Mumtaz et al. 1994). Other public health aspects of chemical mixtures and TPH have recently been reviewed (Hansen et al. 1998; Todd et al. 1999)

The mixtures of concern for TPH are not the heterogeneous petroleum products, but rather the transport fractions to which populations are more likely to be exposed. Thus, use of health effects data for these fractions would be preferable. When health effects data for petroleum products (mixtures) similar in composition to these fractions are not available, data for individual constituents could be used as surrogates, taking into account the potential for toxicologic interactions. Given the complexity of the interactions data for the individual constituents (Section 6.9) however, the assumption that the toxicity of the constituents is additive may be the most reasonable approach. This implicit assumption underlies the adoption of an MRL as a surrogate value to represent the toxicity of an entire fraction.

6.1.2 Existing Risk-Based Methods for TPH Health Assessment

This section presents approaches of other organizations. The ATSDR approach is presented in Section 6.1.3.

The American Society for Testing and Materials (ASTM) Approach. ASTM (1995) developed a Risk-Based Corrective Action (RBCA) approach for petroleum release sites. Additional information regarding this approach is provided in previous sections of this document and in Chapter 7. The present discussion is limited to health effects aspects of the approach. The RBCA approach is not limited to TPH, but includes any chemical that may be associated with petroleum product releases, including nonhydrocarbon constituents and additives. ASTM used an indicator compound approach that assumes that a significant portion of the total potential impact on human health from all chemicals in a petroleum product spill is due to the indicator compounds, termed chemicals of concern. The ASTM approach assesses the risk of exposure to each chemical of concern separately during the derivation of Tier 1 (general) risk-based screening levels, and Tier 2 and 3 site- specific target levels for contaminated media. Although the use of whole mixture toxicity data and the assumption of additivity for the toxicity of individual chemicals in a mixture were mentioned as options for Tier 2 and 3, neither approach was recommended by ASTM. The criteria to be used in selection of the chemicals of concern for various petroleum products are concentrations in the product, solubility and mobility, toxicological properties, aesthetic characteristics (e.g., odor), and availability of sufficient information to conduct risk assessments. For gasoline, kerosene, and jet fuels, commonly selected hydrocarbon chemicals of concern are benzene, toluene, ethylbenzene, and xylene (BTEX). Additional chemicals of concern for kerosene and jet fuels are PAHs. For diesel fuel, light fuel oils, and heavy fuel oils, the commonly selected hydrocarbon chemicals of concern are PAHs. Twelve PAHs, including benzo(a)pyrene, were selected for consideration.

The MADEP Approach. The MADEP (Hutcheson et al. 1996; MADEP 1997, 1999) recommends the use of a combination indicator compound and fraction approach for the assessment of health effects from TPH in soil and water as follows:

Carcinogenic Effects. Specific petroleum hydrocarbon indicator compounds that have EPA cancer potency factors are assessed; these are benzene and benzo(a)pyrene. EPA relative potency factors can be used for benz(a)anthracene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, chrysene, benzo(b)fluoranthene, and benzo(k)fluoranthene.

Noncarcinogenic Effects. The following petroleum hydrocarbon fractions were established based on molecular structure (aromatic versus aliphatic) and then on number of carbon atoms, using toxicologically similar groupings and excluding compounds with less than 5 carbons because their high volatility precludes chronic exposure from spills/releases. With the exception of the aromatic C_5-C_8 fraction, the toxicity of each fraction is represented by the RfD for a representative “reference compound” from the fraction. Analytical methods for these fractions have also been suggested (Section 3.3). Some of these fractions include subfractions that were combined because of similarity of toxicity across fractions or limitations in the toxicity data.

Aromatic fractions

C_5-C_8 , assessed on the basis of the individual indicator compounds-benzene (MADEP RfD derived from inhalation study), toluene, ethylbenzene, and xylenes (EPA RfDi).

C_9-C_{10}, using an EPA RfD for pyrene (the lowest RfD for compounds in this group) as a surrogate and an RfC for xylenes.

$C_{11}C_{12}$, using and EPA RfD for pyrene and an RfC for naphthalene.

Aliphatic fractions

C_5-C_8, using an EPA RfD and RfC for *n*-hexane as a surrogate.

C_9-C_{12}, using a MADEP RfD and RfC for *n*-nonane as a surrogate, based on estimated relative potency of *n*-nonane as compared with *n*-hexane.

C_{13}-C_{18}, using a MADEP RfD and RfC for naphthalene as a surrogate.

$C_{19}C_{35}$,using a MADEP RfD for white mineral oil (but listing eicosane as the reference compound).

The MADEP (1997) has published a draft report for public comment regarding implementation of their approach. This report references the TPHCWG (1997a, 1997b, 1997c) approach (below), particularly in defining fractions with regard to transport properties, which are related to the equivalent (or relative) carbon number indexes for the compounds.

The TPHCWG Approach. The TPHCWG (1997a, 1997b, 1997c) also recommends a combination indicator compound and fraction approach for TPH, but it differs from the MADEP approach in the elimination of assessment for noncarcinogenic effects if carcinogens are present above regulatory criteria, in the basis for selection of the fractions, and in a more extensive use of toxicity data for mixtures to represent the toxicity of the fraction. Some petroleum hydrocarbon fractions listed below include subfractions that were combined because of similarity of toxicity across fractions or limitations in the toxicity data.

Carcinogenic Effects. Specific petroleum hydrocarbon indicator compounds that have EPA cancer potency factors are assessed (i.e., benzene and benzo(a)pyrene).

Noncarcinogenic Effects. These effects are assessed only if the carcinogenic indicator compounds are not detected or are below regulatory criteria. The following petroleum hydrocarbon fractions, minus the carcinogenic indicator compounds, were selected as representing compounds with similar transport properties. Toxicity values for constituents of the fraction or for a similar mixture were selected to represent the toxicity of the fraction. Aromatic and aliphatic hydrocarbons are considered separately and further subdivided on the basis of equivalent carbon number index (EC). This index is equivalent to the retention time of the compounds on a boiling point GC column (non-polar capillary column), normalized to the *n*-alkanes. Physical and chemical properties of hydrocarbons that are useful in predicting transport (vapor pressure, solubility, partition coefficient, Henry's law constants) are predictably related to the EC and can be estimated using algorithms (see Chapter 5).

Aromatic fractions

EC_5-EC_8, using EPA RfD and RfC for toluene as a surrogate.

EC>$_8$-EC_{16}, using EPA RfDs (all the same value) for two compounds (cumene [isopropylbenzene] and naphthalene) as a surrogate and an RfC for C_9 aromatics (hi-flash aromatic naphtha).

$EC_{>16}EC_{35}$, using the EPA RfD for pyrene (C_{16}) as a surrogate. Anthracene, fluorene, and fluoranthene are also in this group; however, pyrene was selected because it had the lowest RfD.

Aliphatic fractions

EC_5-EC_8, using TPHCWG RfD (derived from inhalation data) as a surrogate and RfC for commercial hexane, a mixture of C_6 hydrocarbons containing 53% *n*-hexane.

$EC_{>8}$-EC_{16}, using TPHCWG RfD and RfC for dearomatized petroleum streams (white spirit).

$EC_{>14}$-EC_{35}, using TPHCWG RfD for white mineral oils.

The MADEP (Hutcheson et al. 1996; MADEP 1997) and the TPHCWG (1997a, 1997b, 1997c) approaches both assume additivity of the indicator compounds and the hydrocarbon fractions in assessing the potential for adverse effects of TPH on health. In contrast, the ASTM approach ten to assess each individual TPH indicator chemical separately and without regard to the presence of other petroleum hydrocarbons and the potential for additivity or interactions, although it does not preclude a consideration of these factors.

6.1.3 Overview of the ATSDR Approach

In formulating an approach to health assessment of TPH, ATSDR has drawn on the experience of other groups that have been developing approaches to health-based assessment for TPH (i.e., ASTM [1995]; Hutcheson et al. [1996]; and TPHCWG [1997a, 1997b, 1997c]), but has developed an approach designed to address its own specific concerns and mandates. A notable difference between ATSDR and these other groups is that the other groups have focused on longer-term exposure scenarios, whereas ATSDR is concerned with the entire spectrum of possible exposure periods from acute through chronic. In addition, the health guidance values developed by ATSDR, MRLs, are intended to serve as screening levels by ATSDR health assessors to identify contaminants and potential health effects that may be of concern at hazardous waste sites. **MRLs are not intended to define clean-up or action levels.**

The ATSDR approach, as reflected in this profile, focuses on an assessment of the health effects of petroleum hydrocarbon transport fractions, as suggested by the TPHCWG (1997a, 1997b, 1997c). This approach is the most universally useful, given the limitations to using data for the whole petroleum products or individual constituents, discussed in Chapter 2 and in Section 6.2.1 above. Methods of analysis for these fractions are available, and modeling can be performed to predict exposure to the fractions. The assessment of the health effects of the fractions by ATSDR is similar but not identical to that of the TPHCWG. In addition, to capitalize on the best features of the MADEP (Hutcheson et al. 1996) and TPHCWG (1997a, 1997b, 1997c) approaches, the aromatic EC_5-EC_8 fraction has been redefined as an EC_5-EC_9 fraction, so that it includes all the BTEXs. The aromatic $EC_{>8}$-EC_{16} fraction is then redefined as an $EC_{>9}$-EC_{16} fraction.

Carcinogenic Effects. Specific hydrocarbon indicator compounds that have EPA cancer risk estimates are assessed; these are benzene and benzo(a)pyrene. EPA relative potency factors can be used for benz(a)anthracene, indeno(1,2,3-cd)pyrene, dibenz(a,h)anthracene, chrysene, benzo(b)fluoranthene, and benzo(k)fluoranthene.

Noncarcinogenic Effects. The following petroleum hydrocarbon fractions, including the carcinogenic indicator compounds, were selected as representing compounds with similar transport properties, based on the recommendations of the TPHCWG (1997b, 1997c), with an adjustment of the lower EC aromatic fractions in order to include all the BTEXs in the first fraction, as discussed above. As with the MADEP and TPHCWG approaches, some of the fractions include subfractions that have been combined because of similarity of health effects across fractions or limitations in the health effects data. Provisional recommendations regarding suitable MRLs are made, using a surrogate approach as needed and appropriate. The MRL for the surrogate compound or for a petroleum product similar in composition to the fraction is used to indicate the potential toxicity of the entire mass of the fraction.

Aromatic Fractions

EC_5EC_9, using inhalation and oral MRLs specific to each individual indicator compound-benzene, toluene, ethylbenzene, and the xylenes.

$EC_{>9}$-EC_{16}, using a chronic inhalation MRL and acute and intermediate oral MRLs for naphthalene as surrogates.

EC_{16}-EC_{35}, using an intermediate oral MRL for fluorene and fluoranthene as a surrogate.

Aliphatic Fractions

EC_5-EC_8, using a chronic inhalation MRL for *n*-hexane as a surrogate.

$EC_{>8}$-EC_{16}, using a chronic inhalation MRL for JP-7.

$EC_{>16}$-$EC_{>35}$, using health effects data for mineral oils, but no MRLs are available.

The health effects of these fractions are discussed in Section 6.2, and details of the selection of the fraction-specific MRLs can be found in Section 6.6. These fraction-specific values are provisional values, reflecting the uncertainty inherent in this approach, as discussed in Section 6.6. Further information on ATSDR MRLs is given in Appendix A, while information on other toxicity criteria such as RfDs and RfCs, is provided in Chapter 7.

ATSDR has already prepared toxicological profiles on a large number of individual constituents of TPH and on a number of whole petroleum products. In order to give an overall perspective on the toxicology of TPH, without duplicating the existing profiles, this toxicological profile will present brief summaries of the health effects of these individual petroleum hydrocarbon compounds and petroleum products. MRLs have been derived for a number of these compounds, which serve as indicator and surrogate compounds for the ATSDR approach as outlined above. Thus, consideration of these compounds as part of the TPH contamination profile is useful. Similarly, information regarding the extent and identity of petroleum product contamination may be available, and toxicity information and MRLs for these original products may be useful in some circumstances for assessing potential health effects. These brief summaries of information on the individual compounds and on petroleum products that are representative of particular fractions occur during the discussion of the health effects of the fractions in Section 6.2. Information on petroleum products, including the more heterogenous mixtures, also is presented in Section 6.3. The reader is encouraged to consult the original toxicological profiles listed in Appendix A and other cited sources for more detail.

The content of this chapter and this document is different from that of a standard toxicological profile, in recognition of the extensive assessments of individual petroleum hydrocarbons already performed by ATSDR and other agencies, and the need for an approach that focuses on the most important information. This chapter presents the ATSDR perspective and approach, and serves as a guide to sources of more detailed information.

6.2 DISCUSSION OF HEALTH EFFECTS BY FRACTION AND ROUTE OF EXPOSURE

Because of the complexity of TPH, and the existence of extensive ATSDR and TPHCWG documentation for constituents of TPH and for petroleum products and mixtures corresponding to some of the fractions, this section of the document adopts a “handbook approach” to delineating the health effects of TPH. The organization and content of this section, while retaining an emphasis on route and duration of exposure and on type of health effect, is streamlined in order to avoid duplication of existing resources and to help public health professionals, and others who address the needs of people living or working near hazardous waste sites, to gain an understanding of the characteristic health effects of TPH fractions. The juxtaposition of information on fraction composition with information on health effects for fraction constituents facilitates evaluation of the suitability of the existing health effects information to represent the potential health effects of the entire fraction. Further discussion of the suitability and representativeness of the information is presented in Section 6.6.

Thus, for each fraction, the components of the fraction are delineated first. Health effects for the fraction are then discussed by route of exposure. This discussion includes information on individual constituents of the fraction and on mixtures that correspond to the fraction. The text focuses on the major, sensitive, and/or characteristic end points.

The figures give a *condensed picture* of exposure-effect relationships for each fraction. They show the lowest reliable lowest-observed-adverse-effect-level (LOAEL) in animals and humans for each route, exposure period, and end point, including cancer. The three exposure periods-acute (14 days or less), intermediate (15-365 days), and chronic (365 days or more)-are represented. Different symbols are used to represent different compounds or mixtures, with open symbols for animals and closed for humans. For additional information, including no-observed-adverse-effect levels (NOAELs), classification of LOAELs into "less serious" or "serious" effects, and details of the actual studies, the reader is encouraged to consult the sources referenced in the figures. Because cancer effects could occur at lower exposure levels than the exposures plotted in some of the figures, these figures also show a range for the upper bound of estimated excess risks, ranging from an estimate of 1 in 10,000 to 1 in 10,000,000 ($l0^{-4}$ to 10^{-7}), as developed by EPA.

In addition, estimates of minimal risk to humans (MRLs) are plotted. An MRL is defined as an estimate of daily human exposure to a substance that is likely to be without an appreciable risk of adverse effects (noncarcinogenic) over a specified duration of exposure. MRLs are derived when reliable and sufficient data exist to identify the target organ(s) of effect or the most sensitive health effect(s) for a specific duration within a given route of exposure. MRLs are based on noncancerous health effects only and do not consider carcinogenic effects. MRLs can be derived for acute, intermediate, and chronic duration exposures for inhalation and oral routes. Appropriate methodology does not exist to develop MRLs for dermal exposure.

Although methods have been established to derive these levels (Barnes and Dourson 1988; EPA 199Oc), uncertainties are associated with these techniques. Furthermore, ATSDR acknowledges additional uncertainties inherent in the application of the procedures to derive less than lifetime MRLs. As an example, acute inhalation MRLs may not be protective for health effects that are delayed in development or are acquired following repeated acute insults, such as hypersensitivity reactions, asthma, or chronic bronchitis. As these kinds of health effects data become available and methods to assess levels of significant human exposure improve, these MRLs will be revised.

The figures in this section were compiled primarily from the tables and figures showing *Levels of Significant Exposure* in ATSDR toxicological profiles. To fill data gaps for some of the fractions, pertinent additional health effects information from EPA sources and from the TPHCWG (1997c) was included. MADEP also was consulted, but did not appear to provide significant additional information for this purpose. (RfCs and RfDs from these sources are reported in Chapter 7.)

6.2.1 Aromatic EC_5-EC_9 Indicator Compounds

This fraction consists of indicator compounds: benzene, toluene, ethylbenzene, and xylene (mixture and individual isomers *o*-, *m*-, *p*-). These indicator compounds are often referred to as the BTEXs, and are commonly assessed using MRLs (or EPA toxicity values) specific to each compound. Styrene also would fall in this fraction, but does not appear to be a significant constituent of the petroleum products whose composition was reported by TPHCWG (1997c). The BTEXs are the subject of separate ATSDR toxicological profiles (ATSDR 1994, 1995b, 1997a, 1999a); these profiles should be consulted for detailed information on these compounds. The information in Sections 6.2.1.1 through 6.2.1.3 is taken from these profiles; for the sake of readability, references to these ATSDR profiles will not be repeated in these sections.

6.2.1.1 Inhalation Exposure

All the BTEXs cause neurological effects. Neurological effects are the basis for MRLs for both acute and chronic exposures to toluene and mixed xylenes, and for intermediate exposures to benzene; neurological effects are not as sensitive for ethylbenzene. The neurological effects consist primarily of central nervous system depression. Toluene's neurotoxicity also includes ototoxicity. Evidence of hearing loss has been seen in both occupationally exposed humans and in animals. There is limited evidence that chronic inhalation exposure to benzene may affect the peripheral nervous system; this evidence is from a single study of occupationally exposed humans who also had aplastic anemia.

Benzene is the only BTEX that has well characterized hematological, immunological, and lymphoreticular effects in humans and animals at low levels of inhalation exposure. Immunological and lymphoreticular effects are the basis for the derivation of the acute inhalation MRL for benzene. Benzene affects hematopoiesis, decreasing the production of all major types of blood cells, and can also cause hyperplasia.

Developmental effects are the basis for intermediate MRLs for ethylbenzene and mixed xylene, indicating that the embryo/fetus may be particularly sensitive to these two BTEXs.

Benzene is considered to be carcinogenic to humans by the inhalation route of exposure (EPA weight-of-evidence Group A, human carcinogen). Occupational exposure to benzene was associated with increased incidences of nonlymphocytic leukemia. Studies in animals also found increased incidences of neoplasia in animals treated by inhalation or gavage with benzene.

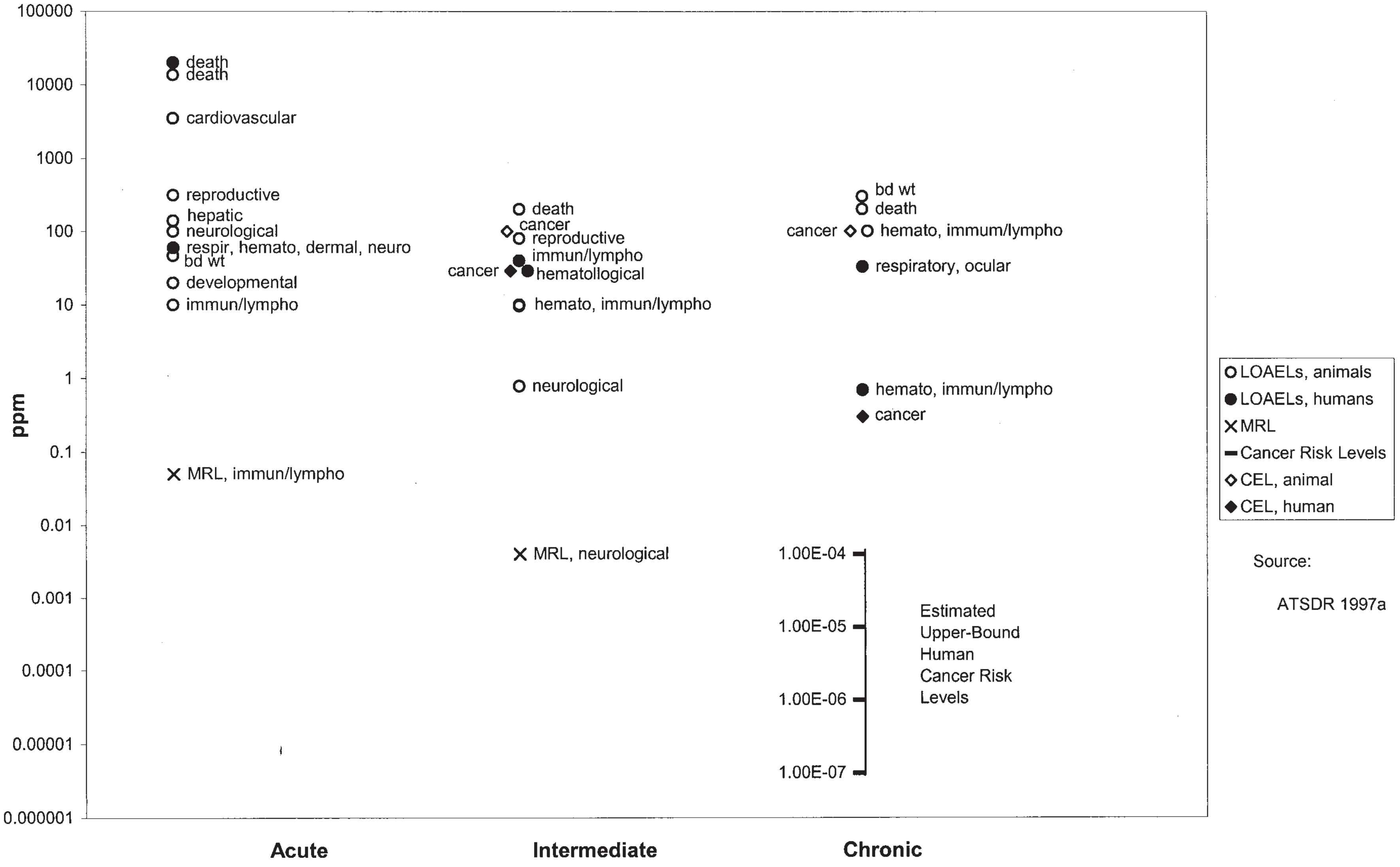
Although ethylbenzene was classified in EPA weight-of-evidence Group D (not classifiable as to human carcinogenicity), subsequent publication of a chronic inhalation study of ethylbenzene provides evidence of carcinogenicity in rats and mice, and indicates a need for reassessment. Toluene and mixed xylene are classified in Group D.

The lowest reliable LOAEL values for the BTEXs are summarized in Figure is 6-l through 6-4, as are MRLs and cancer risk levels. The data for each compound are presented in a separate figure because of the voluminous data available for each and because these compounds are commonly assessed using the exposure data and MRLs (or EPA toxicity values) specific for each. The data for mixed xylene are extensive, and MRLs are available for all three durations, whereas little data and no MRLs are available for the individual isomers (*o*-, *m*-, and *p*-). The inhalation toxicity data for the individual isomers are reasonably similar to those for the mixture. Accordingly, only the data for mixed xylene are included in the figure. More detailed information is available in the ATSDR toxicological profiles on the individual compounds (ATSDR 1994, 1995d, 1997a, 1999a), from which the information in this section is drawn.

6.2.1.2 Oral Exposure

Data for the oral route of exposure are less extensive. The BTEXs cause neurological effects, generally central nervous system depression, by the oral route. This is a sensitive effect for toluene and *p*-xylene, for which it is the basis of acute and/or intermediate MRLs. Renal and hepatic effects are also seen with oral exposure to these compounds. Renal effects are the basis for the intermediate MRL for mixed xylenes and hepatic effects are the basis for the intermediate MRL for *m*-xylene. The hepatic effects tend to be mild, including increased liver weight and cytochromes P-450 and b5 contents. Benzene causes hematological effects by the oral route that are similar to those seen from inhalation exposure.

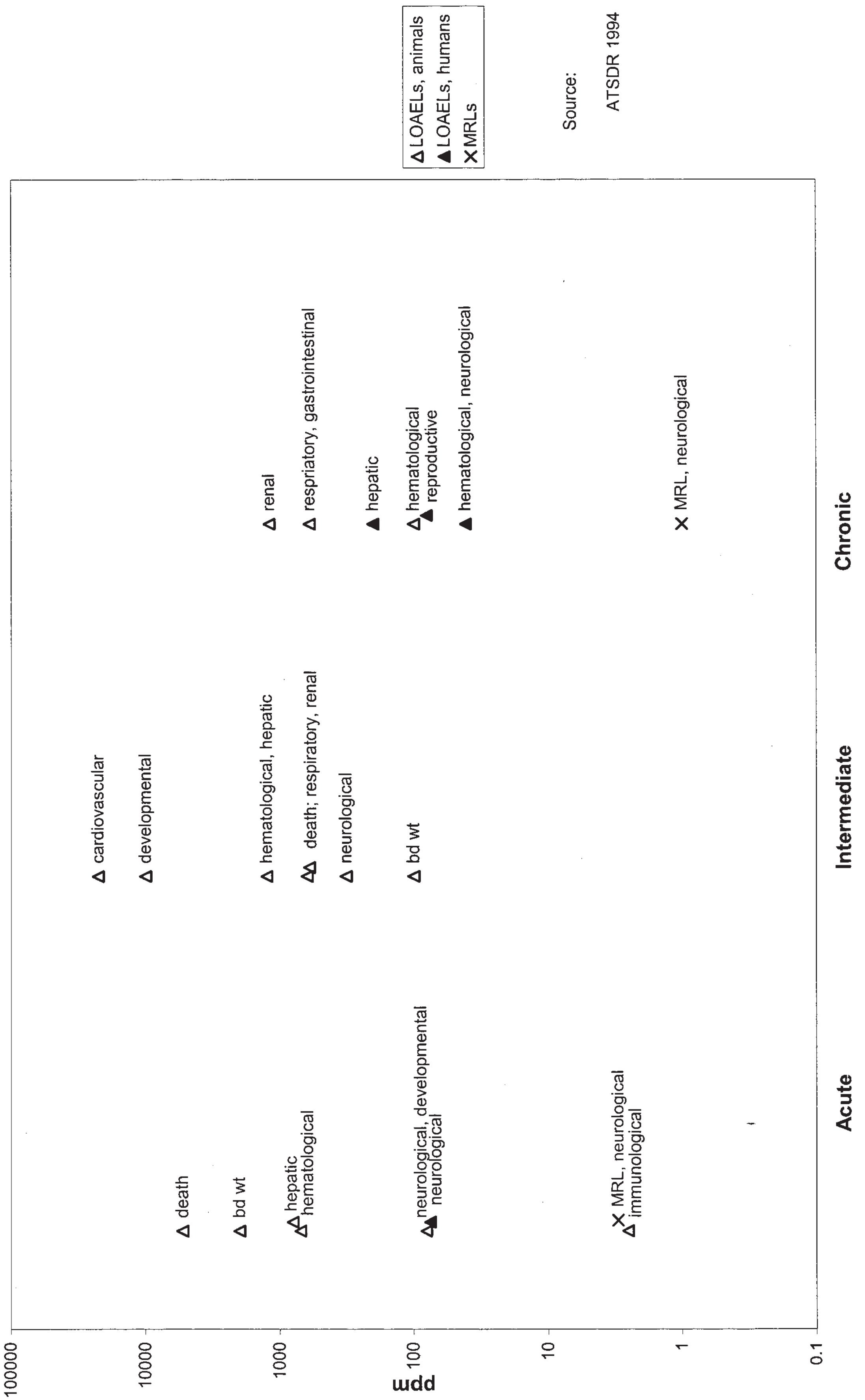
Figure 6-1. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Inhalation - Benzene



Source:

ATSDR 1997a

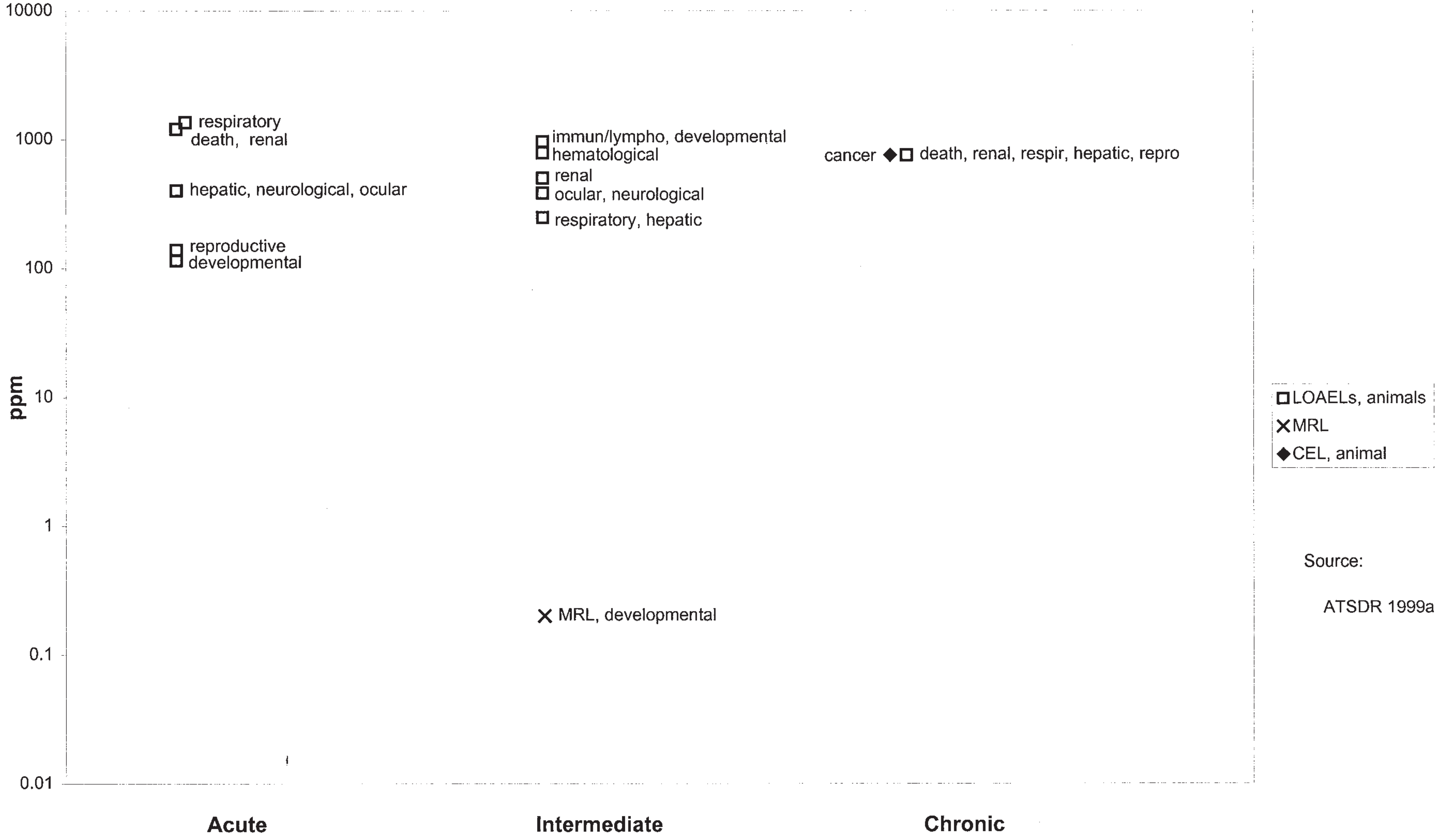
Figure 6-2. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Inhalation - Toluene



Source:

ATSDR 1994

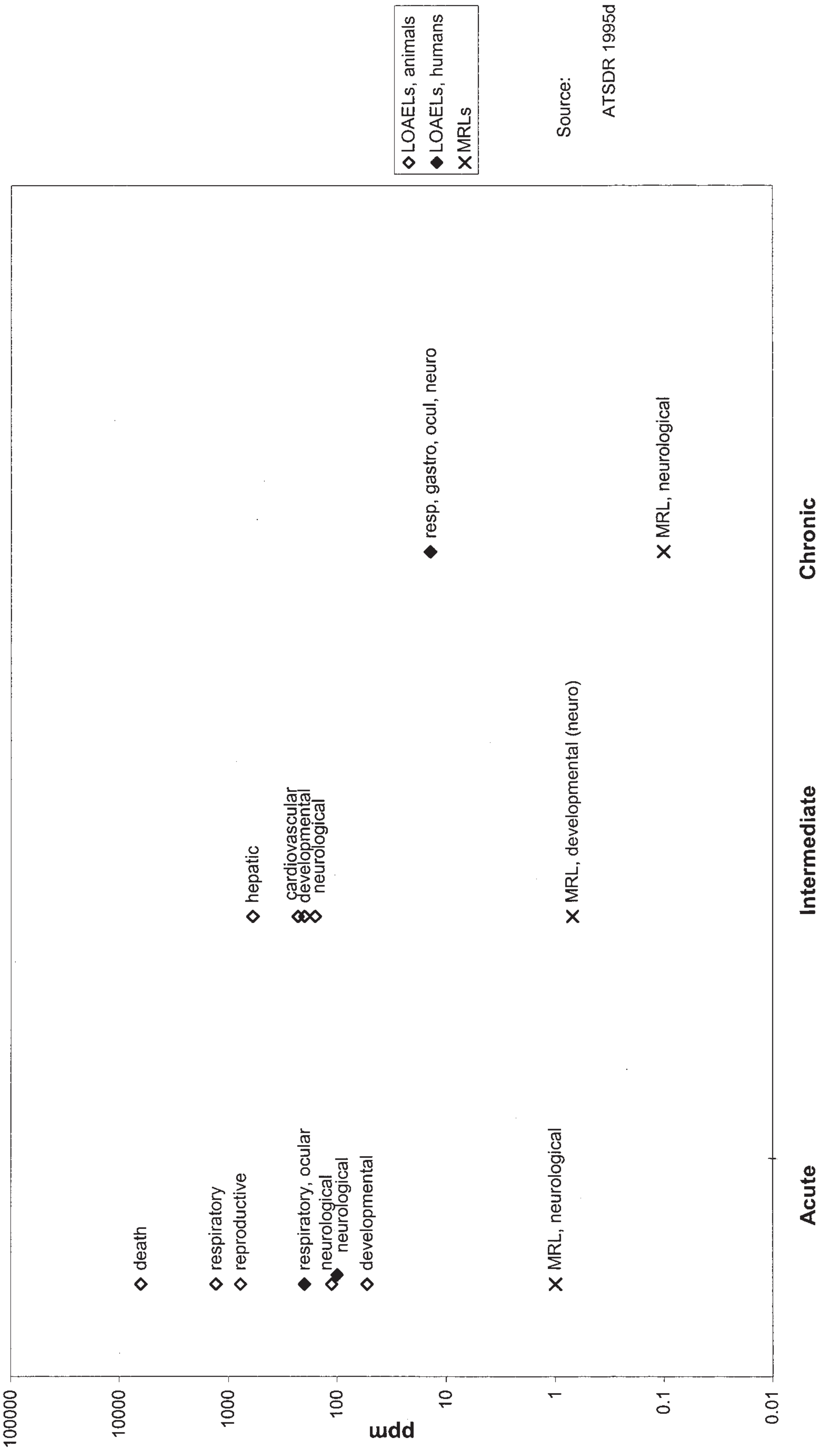
Figure 6-3. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Inhalation - Ethylbenzene



Source:

ATSDR 1999a

Figure 6-4. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Inhalation - Mixed Xylene



Source:

ATSDR 1995d

Benzene is considered to be carcinogenic (EPA weight-of-evidence Group A) to humans by either inhalation or oral exposure, based on occupational studies that showed increased incidences of nonlymphocytic leukemia in humans exposed by inhalation, with supporting data from oral and inhalation studies in animals. Results of a recently published study of ethylbenzene in animals indicate carcinogenicity by the inhalation route, but there is no evidence of carcinogenicity by the oral route. Toluene and mixed xylene are classified in EPA weight of evidence Group D (not classifiable as to human carcinogenicity).

The lowest reliable LOAEL values for the BTEXs are summarized in Figures 6-5 through 6-7, as are MRLs and cancer risk levels. With the exception of ethylbenzene, the data for each of the BTEXs are presented in a separate figure because of the voluminous data available for each and because these compounds are commonly assessed using the exposure data and MRLs (or EPA toxicity values) specific for each. There are only two pertinent LOAELs and no MRLs for ethylbenzene, so the LOAELs for ethylbenzene are plotted with those for toluene, and indicated by a different symbol. More detailed information is available in the ATSDR toxicological profiles on the individual compounds (ATSDR 1994, 1995d, 1997a, 1999a), from which the information in this section is drawn.

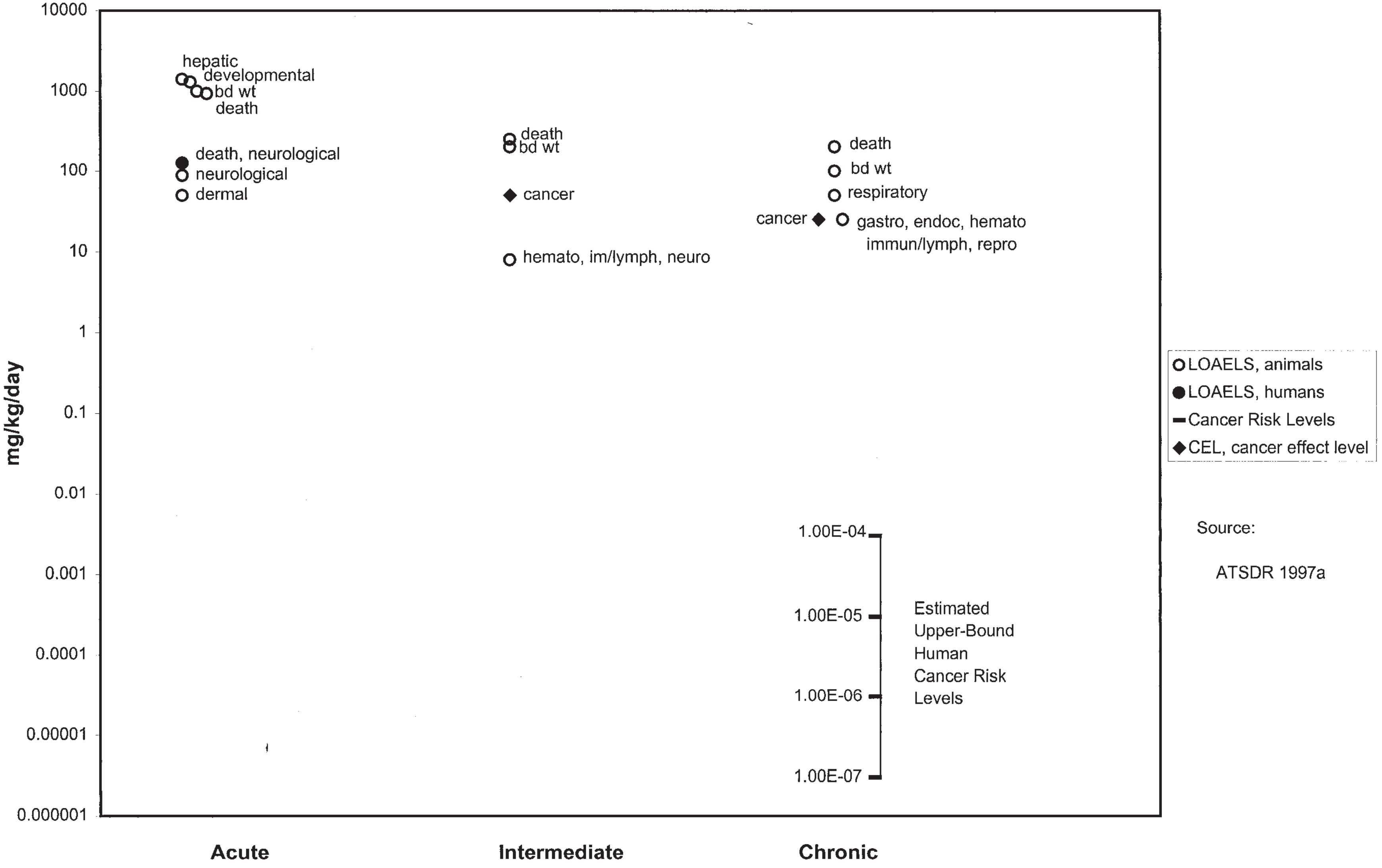
6.2.1.3 Dermal Exposure

Information on the health effects of dermal exposure to the BTEXs is limited. Skin and eye irritation are well documented, but effects from systemic absorption are not. ATSDR (1997a) concluded that it is reasonable to expect that adverse hematological and immunological effects might occur following dermal exposure to benzene, because benzene is absorbed through the skin and absorption through any route would increase the risk of these effects. For more detailed information, see the ATSDR toxicological profiles on the individual compounds (ATSDR 1994, 1995d, 1997a, 1999a), from which the information in this section is drawn.

6.2.2 Aromatic $EC_{>9}$-EC_{16} Combined Fractions

$EC_{>9}$-EC_{10} fraction: includes cumene (isopropylbenzene), *n*-propylbenzene, the methyl-ethylbenzenes, some trimethylbenzene isomers, and the branched-chain butylbenzenes. None of these compounds is the subject of an ATSDR toxicological profile.

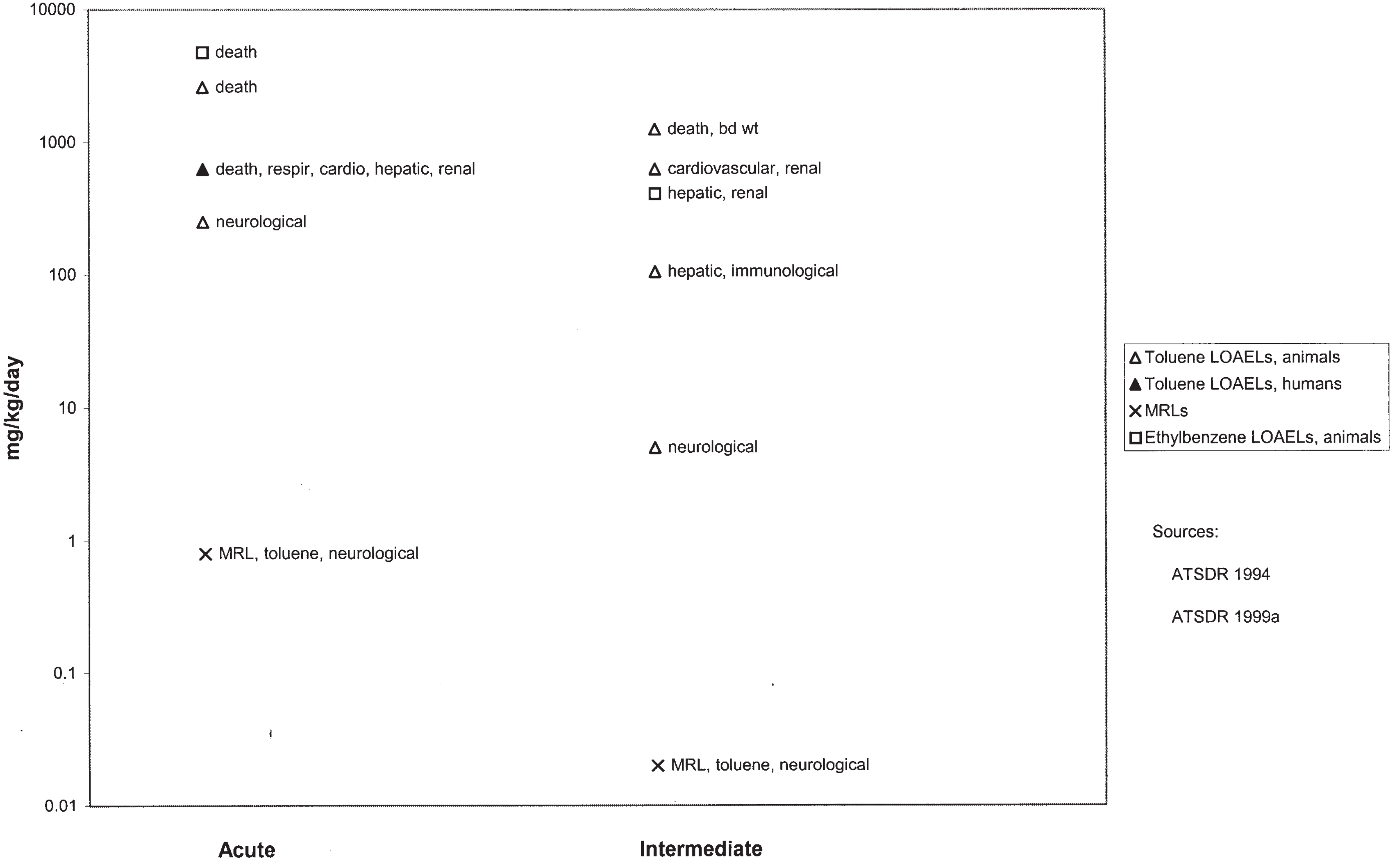
Figure 6-5. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Benzene - Oral



Source:

ATSDR 1997a

Figure 6-6. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Oral - Toluene and Ethylbenzene

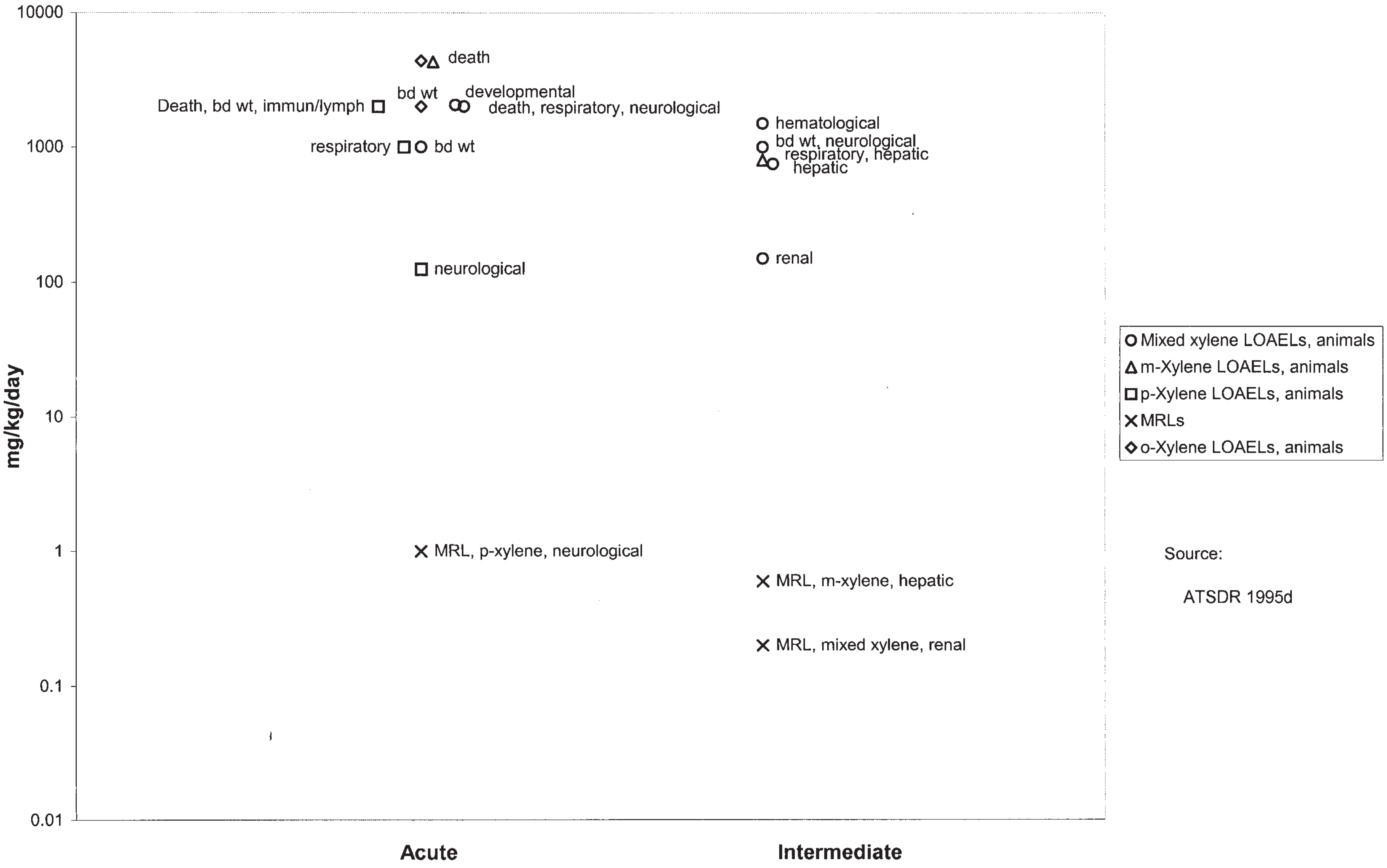


Sources:

ATSDR 1994

ATSDR 1999a

Figure 6-7. Aromatic EC_5-EC_9 Exposures Associated with Health Effects - Oral - Xylenes



Source:

ATSDR 1995d

$EC_{>10}$-EC_{12} fraction: includes *n*-butyl and *n*-pentylbenzene, a trimethylbenzene isomer and various other multi-substituted alkylbenzenes, as well as indan, methylindans and naphthalene. The only compound in this fraction for which an ATSDR toxicological profile is available is naphthalene (ATSDR 1995e).

$EC_{>12}$- EC_{16} fraction: includes a few longer-chain and multi-substituted alkyl benzenes, biphenyls, the mono- and dimethylnaphthalenes, and PAHs, including acenaphthene and acenaphthylene. The monomethylnaphthalenes (l- and 2-methyl naphthalene) are discussed in the ATSDR toxicological profile on naphthalene (ATSDR 1995e) and acenaphthene and acenaphthylene are included in the ATSDR toxicological profile on PAHs (ATSDR 1995f).

6.2.2.1 Inhalation Exposure

No toxicological profiles are available for petroleum hydrocarbons in the $EC_{>9}$-EC_{10} fraction. Inhalation exposure to isopropylbenzene (cumene) and to the trimethylbenzene is known to have neurological and respiratory irritant effects (EPA 1997a, 1998b; TPHCWG 1997c), but these may not be the most sensitive effects of inhalation exposure to the compounds in this fraction. EPA (1998b) concluded that the critical effect of inhalation exposure to isopropylbenzene was increased renal weights in female rats and increased adrenal weights in both sexes of rats in a 13-week inhalation study (Cushman et al. 1995). An RfC was based on these data. Toxicity data for a mixture of C_9 aromatics, consisting primarily of trimethylbenzene and methylethylbenzene isomers, have been assessed (as the basis for an RfC) by the TPHCWG (1997c). The critical effects were hepatic and renal.

Hemolytic anemia is a frequent consequence of acute inhalation exposure to naphthalene in humans, particularly infants and those with a G6PD genetic defect. Exposure-effect relationships for hemolytic anemia are not well characterized. Ocular effects, including cataracts, have been reported in humans exposed to naphthalene vapors, but exposure levels were not known. In mice, respiratory effects are a sensitive effect of inhalation exposure to naphthalene. A chronic MRL has been derived for naphthalene based on respiratory effects in mice-chronic inflammation and regeneration of the nasal epithelium and inflammation of the lung epithelium. In addition, the same study in mice reported an increased incidence of lung adenomas in female but not in male mice (ATSDR 1995e).

The EPA classified naphthalene in Group D (not classifiable as to human carcinogenicity) prior to publication of this study, but notes that naphthalene may be more appropriately classified in Group C (possible human carcinogen) (EPA 1998b).

No MRLs have been developed for compounds in the $EC_{>9}$ –EC_{16} fraction. Only acenaphthylene has been assessed by the EPA for carcinogenicity; the data were considered inadequate (Group D) (ATSDR 1995e, 1995f).

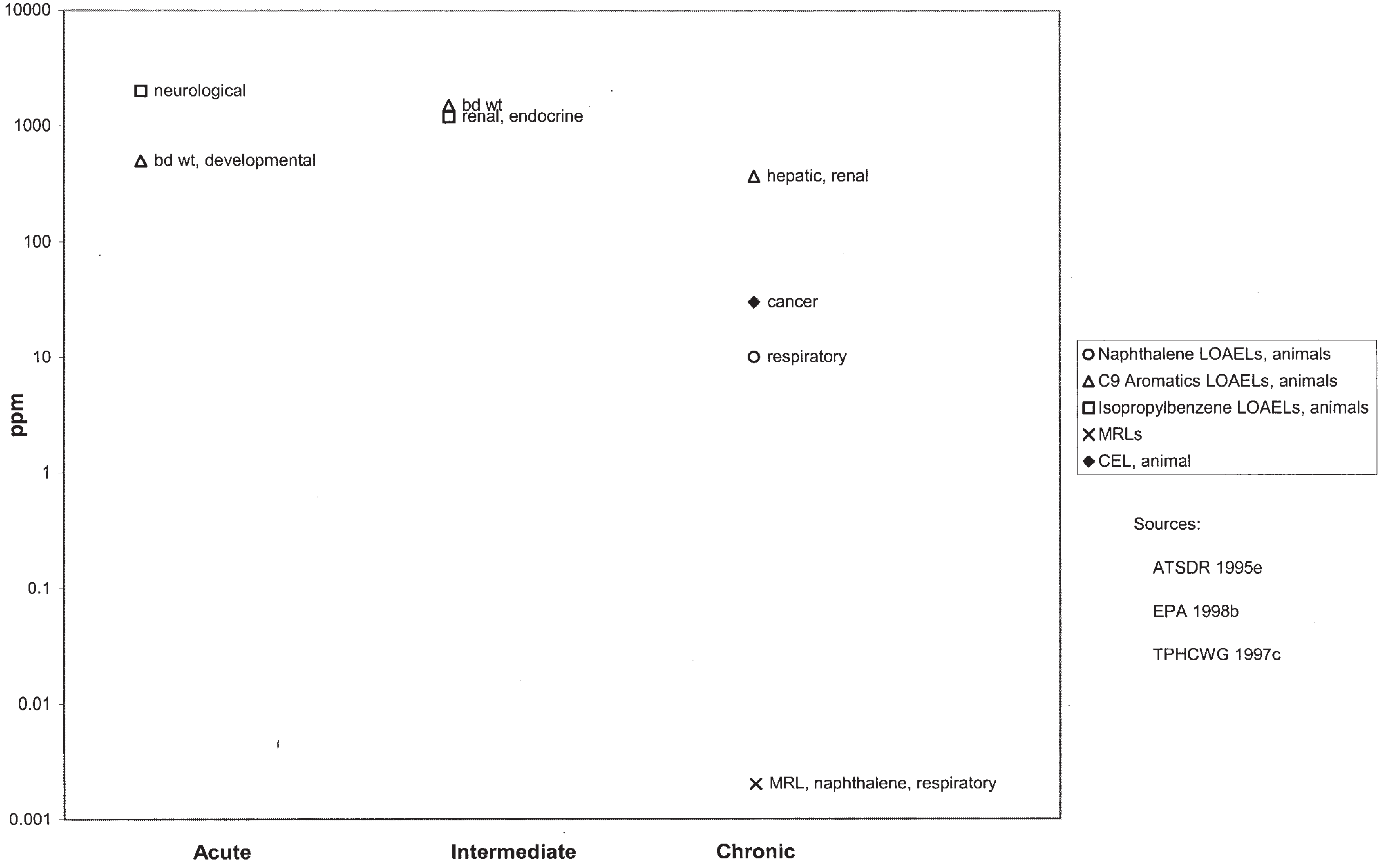
The lowest reliable LOAEL values for the combined aromatic $EC_{>9}$-EC_{16} fraction are summarized in Figure 6-8, as are MRLs. Because so few of the compounds in this fraction have been assessed by ATSDR, additional information from EPA sources and the TPHCWG (1997c) have been added. More detailed information is available in the ATSDR toxicological profiles on the individual compounds and in the other sources noted above.

6.2.2.2 Oral Exposure

There are no toxicological profiles or MRLs for compounds in the $EC_{>9}$-EC_{10} fraction. Toxicity data, primarily from subchronic oral studies in rats, have been assessed by EPA during the derivation of RfDs for two of the compounds-isopropylbenzene (cumene) (EPA 1997a) and 1,3,5-trimethylbenzene (EPA 1996). The critical effect for isopropylbenzene was renal; for 1,3,5trimethylbenzene, the critical effect was a combination of renal, hepatic, and other systemic effects. Oral data for these compounds were limited. Isopropylbenzene has been classified in Group D (not classifiable as to human carcinogenicity) (EPA 1998b). 1,3,5-Trimethylbenzene has not been classified and does not appear to have been studied for carcinogenicity.

Naphthalene, a constituent of the $EC_{>10}$-EC_{12} fraction, produces hemolytic anemia in humans when ingested. As mentioned previously, individuals with a genetic G6PD deficiency have an increased susceptibility to this effect. Little dose-effect information is available for this effect in humans or in animals; dogs appear to be more susceptible than other animal species. Ocular effects occur with high-dose oral administration of naphthalene in animals. The most common effect is cataract formation, but retinal damage has also been noted (ATSDR 1995e). More sensitive effects in animals are neurological effects (central nervous system depression in pregnant animals) and mild hepatic

Figure 6-8. Aromatic $EC_{>9}$-EC_{16} Exposures Associated with Health Effects - Inhalation



Sources:

ATSDR 1995e

EPA 1998b

TPHCWG 1997c

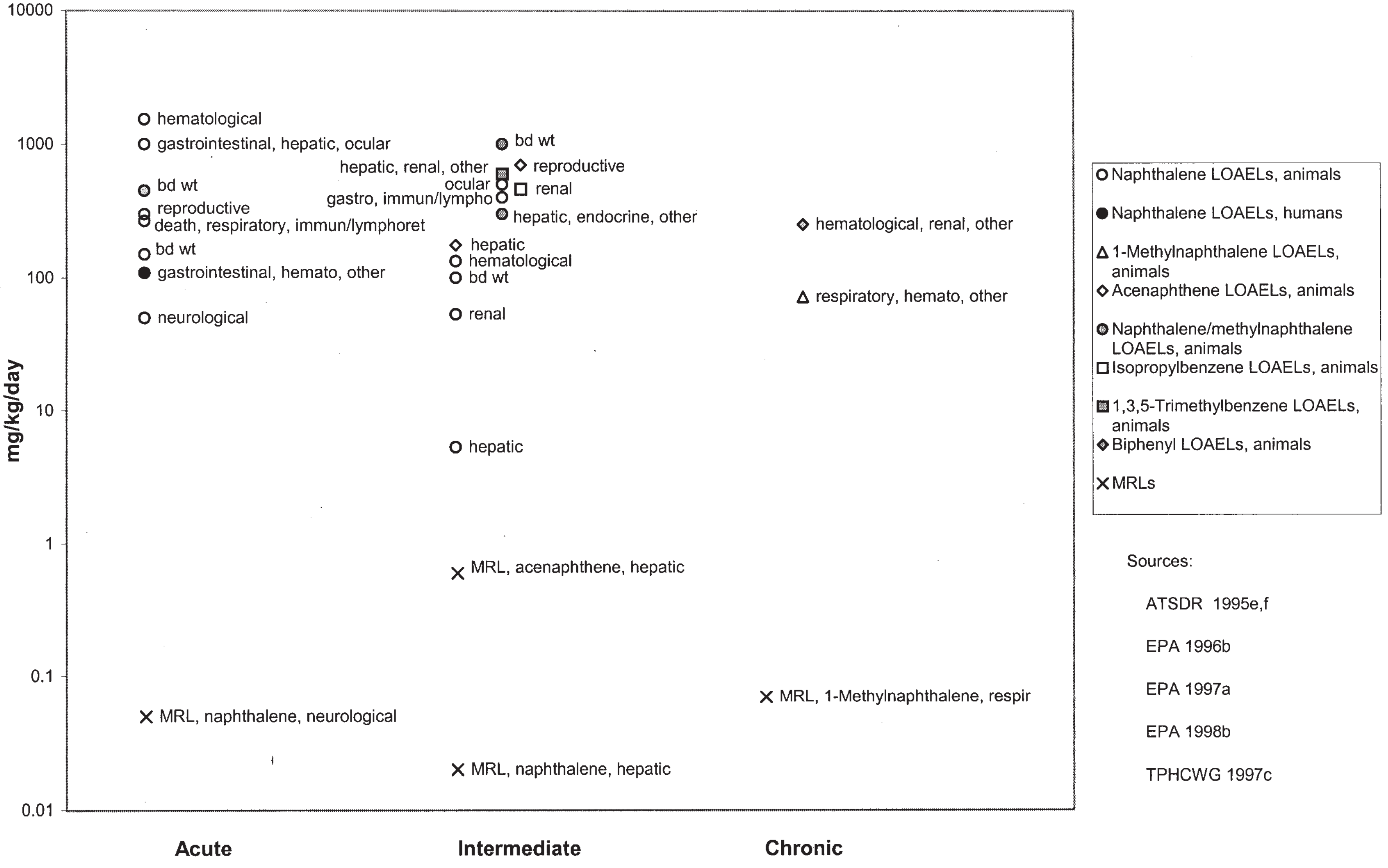
effects (altered microsomal enzyme activities and blood chemistry findings). The EPA classified naphthalene in Group D (not classifiable as to human carcinogenicity) prior to publication of an inhalation study that reported an increased incidence of pulmonary adenomas in female mice, but notes that naphthalene may be more appropriately classified in Group C (possible human carcinogen) (EPA 1998b). No studies documenting carcinogenic effects by the oral route were found (ATSDR 1995e).

Some of the constituents of the $EC_{>12}$-EC_{16} fraction have been evaluated in ATSDR toxicological profiles. Although the database for l-methyl naphthalene is very limited, it includes a chronic study in mice, which serves as the basis for a MRL (ATSDR 1995e). The only effects seen were respiratory (nodular alveolar proteinosis) and hematological (slight increases in hemoglobin parameters and elevated monocyte counts). The limited database for acenaphthene indicates that hepatic effects may be a sensitive consequence of intermediate exposure in mice; the intermediate MRL was based on this finding (ATSDR 1995f). Biphenyl, not included in an ATSDR toxicological profile, has been evaluated by EPA (1998b), which derived an RfD based on renal effects in a chronic study in rats. Hematological effects (reduced hemoglobin), decreased food intake, and decreased longevity also occurred, but renal effects appeared more sensitive. Although the database for this compound is limited, it indicates that reproductive and developmental end points are not as sensitive as renal.

Biphenyl (EPA 1998b) and acenaphthylene (ATSDR 199X) have been classified in Group D (not classifiable as to human carcinogenicity).

The lowest reliable LOAEL values and the available MRLs for the combined aromatic $EC_{>9}$-EC_{16} fraction are summarized in Figure 6-9. Because only a few of the compounds in this fraction have been assessed by ATSDR, additional information from EPA sources and the TPHCWG (1997c) has been added. More detailed information is available in the ATSDR toxicological profiles on the individual compounds and in the other sources noted above.

Figure 6-9. Aromatic $EC_{>9}$-EC_{16} Exposures Associated with Health Effects - Oral



6.2.2.3 Dermal Exposure

The compounds in the combined $EC_{>9}$-EC_{16} fraction are known to be irritating to the skin, but little information is available to suggest systemic toxicity from dermal exposure alone. Naphthalene, however, has caused hematological effects in human infants exposed to diapers that had been treated with naphthalene moth balls (ATSDR 1995e).

6.2.3 Aromatic $EC_{>16}$- EC_{35} Combined Fractions

This fraction consists entirely of PAHs. The more environmentally and toxicologically significant PAHs are the subjects of the ATSDR toxicological profile on PAHs (ATSDR 1995f); two of these PAHs, acenaphthene and acenaphthylene, are constituents of the $EC_{>12}$-EC_{16} fraction, discussed previously, and the remaining 15 are constituents of the $EC_{>16}$- EC_{35} combined fraction, described below.

$EC_{>16}$- EC_{21} fraction: includes anthracene, fluorene, phenanthrene and pyrene, which are discussed in ATSDR (1995f), and other, less well known PAHs such as substituted fluorenes, anthracenes, and phenanthrenes.

$EC_{>21}$- EC_{35} fraction: includes benz(a)anthracene; benzo(b)-, benzo(j)-, and benzo(k)fluoranthene; benzo(g,h,i)perylene; benzo(a)- and benzo(e)pyrene; chrysene; dibenz(a,h)anthracene; fluoranthene; and indeno(1,2,3-c,d)pyrene, which are discussed in ATSDR (1995f), as well as other, less well known PAHs, that include substituted pyrenes, fluorenes, and fluoranthenes.

6.2.3.1 Inhalation Exposure

Little information regarding the inhalation toxicity of PAHs in the $EC_{>16}$-EC_{35} combined fraction is available, and no inhalation MRLs have been derived. A 4-week study of nose-only inhalation exposure of rats to an aerosol of benzo(a)pyrene identified no treatment-related lesions in the respiratory tract or the kidneys at the single exposure level tested. Respiratory effects, including reduced lung function and abnormal chest X-ray, have been seen in humans exposed occupationally to benzo(a)pyrene and particulate matter. Hamsters exposed by inhalation of benzo(a)pyrene particles developed respiratory tract tumors (nasal, pharyngeal, laryngeal, and tracheal) (ATSDR 1995f).

Assessments of carcinogenicity by EPA have placed some of these compounds in EPA Weight-of-Evidence Group B2 (probable human carcinogen) and others in D (not classifiable as to human carcinogenicity). These classifications were based on evidence from dermal and parenteral studies, and for a few PAHs, oral and inhalation studies, all in animals. See Section 6.2.3.2 and Section 6-6 for specific information regarding EPA cancer assessments. The compounds in this EC range are not volatile (TPHCWG 1997c), so inhalation exposure to any of these PAHs as a result of contamination at hazardous waste sites is expected to be minimal under most circumstances. However, people may be exposed by inhaling dust or particles containing PAHs, or by inhaling PAHs released to the air, as vapors or aerosols, from shower water as a result of contamination of groundwater at hazardous waste sites.

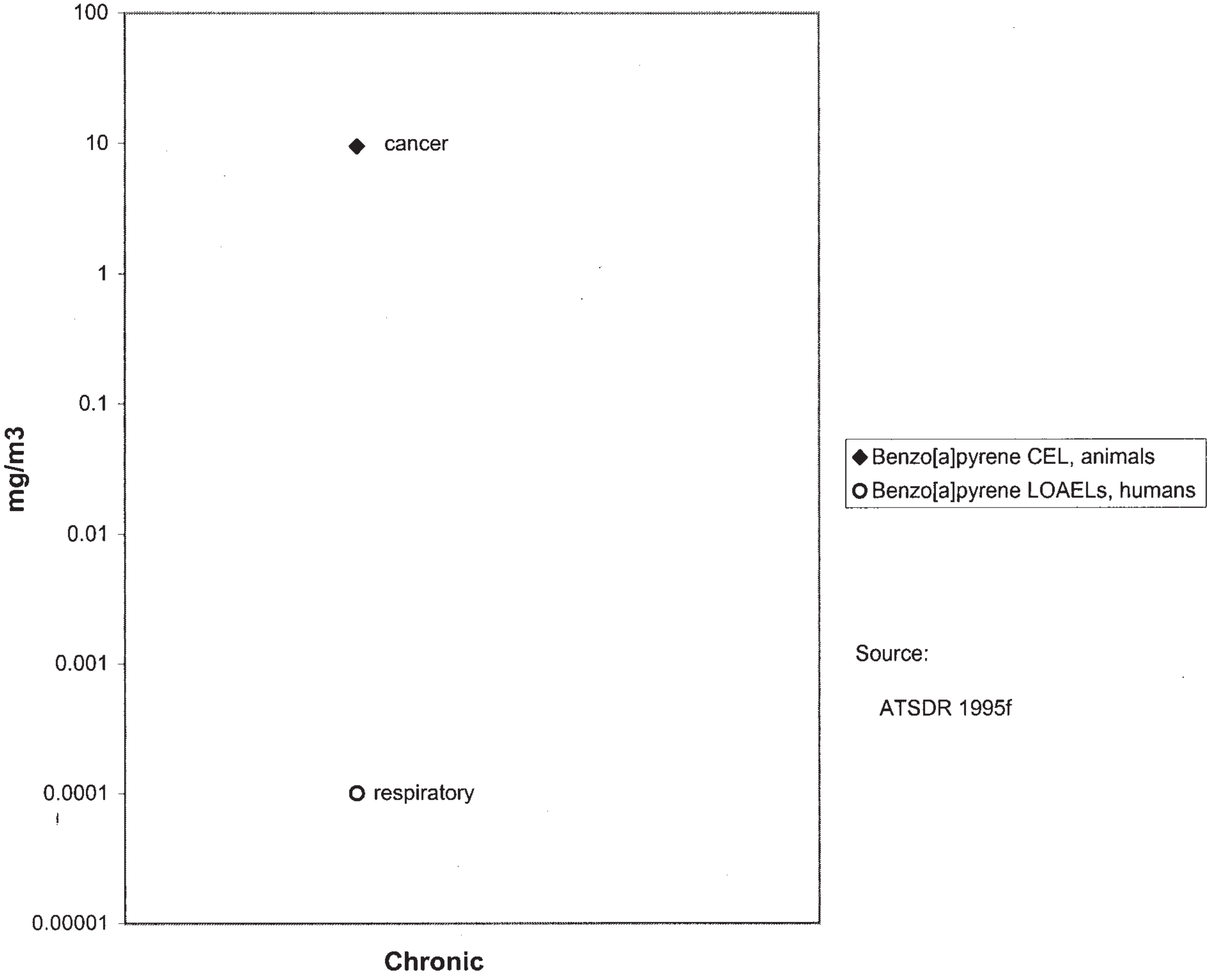
The few available inhalation LOAEL values for the combined aromatic E_{16}-EC_{35} fraction are summarized in Figure 6-10. More detailed information is available in the ATSDR (199%) toxicological profile.

6.2.3.2 Oral Exposure

Data for oral exposure, while more extensive than for inhalation exposure, are nonetheless limited. Hepatic effects appear to be a common sensitive end point of oral exposure to the PAHs in this combined fraction. Renal effects have been seen with some (ATSDR 1995f; EPA 1998b). Aplastic anemia and immunological/lymphoreticular effects have been seen at higher exposure levels.

Intermediate oral MRLs are available for two of the compounds in the $EC_{>16}$–EC_{21} fraction, fluorene and anthracene, based on subchronic studies in mice. The MRL for fluorene was based on hepatic effects (increased liver weight); the MRL for anthracene was based on the absence of any effects, including hepatic, in a similar study (ATSDR 1995f). An EPA-sponsored subchronic oral study of pyrene in mice was used by that agency as the basis for developing subchronic and chronic RfDs (EPA 1997a, 1998b). The critical effect was renal (nephropathy). Hepatic effects were not seen in this study, which is the only subchronic or chronic oral toxicity study of pyrene encountered. All four of the PAHs in this fraction that have been assessed for carcinogenicity by EPA have been classified in EPA Weight-of-Evidence Group D (not classifiable as to human carcinogenicity) (ATSDR 199%).

Figure 6-10. Aromatic $EC_{>16}$-EC_{35} Exposures Associated with Heath Effects - Inhalation



Source:

ATSDR 1995f

The only oral MRL available for compounds in the $EC_{>21}$- EC_{35} fraction is an intermediate MRL for fluoranthene, based on hepatic effects in mice. The sensitive noncancer effect of oral exposure to benzo(a)pyrene is developmental, also determined in animals.

Studies of the compounds in this fraction have focused primarily on potential carcinogenicity. Of the nine compounds in this EC range that have been assessed for carcinogenicity by EPA, seven have been classified in Group B2 (probable human carcinogen), and the remaining two, fluoranthene and benzo(g,h,i)perylene, in group D (ATSDR 1995f; EPA 1997a, 1998b). The evidence has come in large part from parenteral and dermal studies. Oral studies of carcinogenicity have been conducted for six of the PAHs in this EC fraction, with positive results for benzo(a)pyrene, benz(a)anthracene, and dibenz(a,h)anthracene, and with negative results for anthracene, fluoranthene, and fluorene (ATSDR 1995f).

The lowest reliable LOAEL values and the available MRLs for the combined aromatic $EC_{>16}$-EC_{35} combined fraction are summarized in Figure 6- 11, as are cancer risk levels. Information on pyrene is discussed above in this section. Additional information from EPA sources has been added for pyrene. More detailed information on the constituents of this fraction is available in the ATSDR (1995f) toxicological profile.

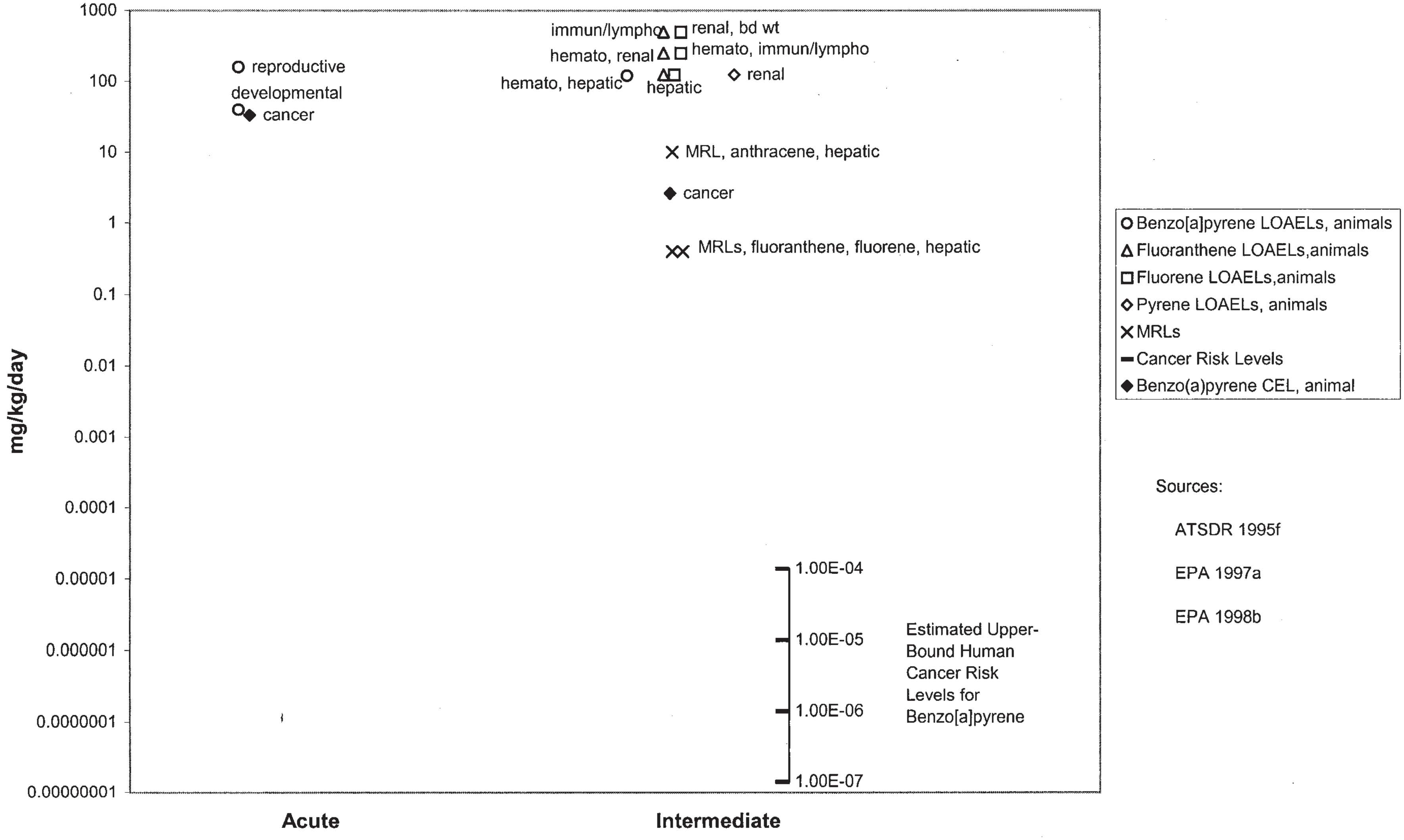
6.2.3.3 Dermal Exposure

The PAHs tend to be irritating to the skin. In addition, benzo(a)pyrene has been shown to cause immunological/lymphoreticular effects evidence as contact hypersensitivity or suppression of this response to other sensitizers. The PAHs classified as B2 carcinogens induce skin tumors following intermediate dermal application to animals (ATSDR 1995f).

6.2.4 Aliphatic EC_5-EC_8 Combined Fractions

EC_5-EC_6 Fraction: includes *n*-pentane, *n*-hexane, the dimethylbutanes and methylpentanes, cyclopentane, and some alkenes. *n*-Hexane is the only compound in this group that is the subject of an ATSDR toxicological profile; some information on commercial hexane (*n*-hexane plus branched and cyclic C_6 alkanes) is included in the same toxicological profile (ATSDR 1999b).

Figure 6-11. Aromatic $EC_{>16}$-EC_{35} Exposures Associated with Health Effects - Oral



Sources:

ATSDR 1995f

EPA 1997a

EPA 1998b

$EC_{>6}$-EC_8 Fraction: includes *n*-heptane, *n*-octane, some branched chain C_6-C_9 alkanes including the trimethylpentanes (note that other branched chain C_9 alkanes fall in the $EC_{>8}$ category) and cycloalkanes, including cyclohexane, methylcyclopentane, and methylcyclohexane, as well as some alkenes. None of these is the subject of an ATSDR toxicological profile.

6.2.4.1 Inhalation Exposure

Inhalation exposure for acute, intermediate or chronic durations to *n*-hexane causes peripheral neuropathy in humans and animals (ATSDR 1999b). The chronic MRL for *n*-hexane is based on this effect in humans. Respiratory and renal effects have been seen in animals exposed to *n*-hexane by inhalation at higher exposure levels than associated with peripheral neuropathy in the same studies. Calculation of human equivalent concentrations (HECs) using EPA dosimetric methodology, however, indicates that respiratory effects were seen in mice exposed subchronically to *n*-hexane at a HEC similar to that for neurological effects in the human study used as the basis for the chronic MRL (EPA 1998b). Thus, respiratory effects also may be sensitive, although confirmation of this in human studies is not available. The other compounds in the EC_5-EC_6 fraction do not appear to cause peripheral neuropathy (ATSDR 1999b; TPHCWG 1997c). Depression of the central nervous system has been seen at relatively high levels of exposure to *n*-hexane. *n*-Hexane has been classified as in weight-of-evidence Group D (not classifiable as to human carcinogenicity) (EPA 1989a).

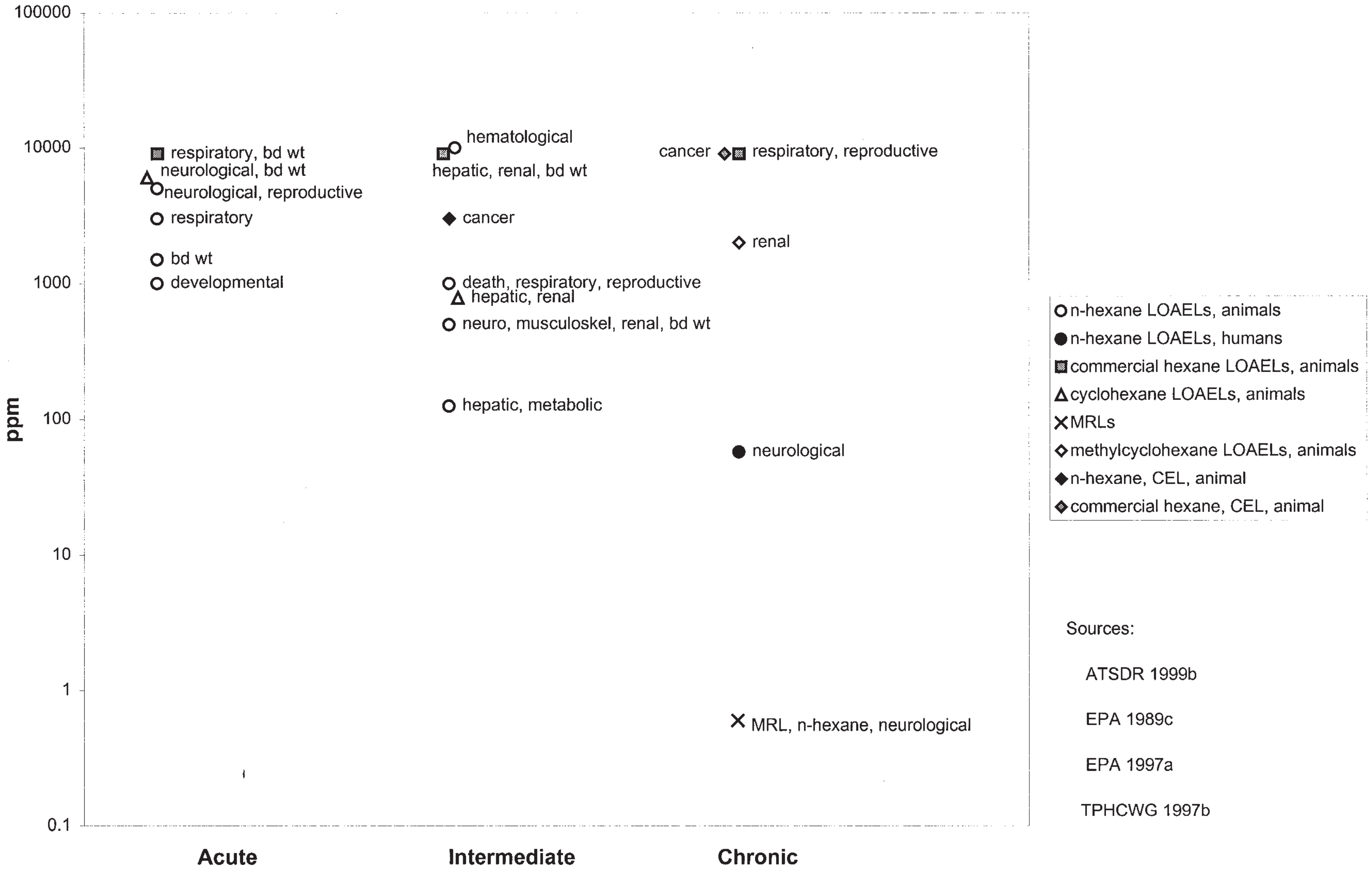
Commercial hexane, which consists of a mixture of C_6 aliphatic compounds including 20-80% *n*-hexane and other straight, branched, and cyclic alkanes in the range of $EC_{5.68}$-$EC_{6.59}$,has been the subject of extensive recent testing as part of a EPA Test Rule under TSCA Section 4. Commercial hexane mixtures have the potential to represent the toxicity of the EC_5-EC_8 combined fraction better than any single compound. The non *n*-hexane components of commercial hexane, when tested separately as a mixture, do not cause peripheral neuropathy, whereas the commercial mixture containing *n*-hexane has been demonstrated to cause peripheral neuropathy in one study in rats (ATSDR 1999b; IRDC 1981). The commercial hexane mixtures tested under the Test Rule contained 53% *n*-hexane, 16% 3-methylpentane, 14% methylcyclopentane, 12% 2-methylpentane, 3% cyclohexane, 1% 2,3-dimethylbutane, and <1% other constituents. According to the TPHCWG (1997c), which developed an RfC for commercial hexane based on preliminary reports of these unpublished studies, the critical effects were respiratory (mucosal irritation in nasal turbinates and larynx in rats) and reproductive (decreased severity and incidence of cystic uterine endometrial hyperplasia in mice) in chronic studies. In addition, liver tumors developed in the female mice, indicating carcinogenic potential.

Cyclohexane also has undergone testing under EPA TSCA Section 4. The TPHCWG (1997c) summarized the preliminary report of the developmental toxicity study in rats, which indicates neurological effects (reduced response to a sound stimulus) in the dams exposed to cyclohexane by inhalation. Hepatic and renal effects were seen in published subchronic studies in animals. No histopathological changes in the peripheral nervous system were seen in a chronic study in animals (TPHCWG 1997c).

Two additional chemicals in the $E_{>6}$-EC_8 fraction that have been the subject of limited toxicity testing are *n*-heptane and methylcyclohexane. Both appear to cause depression of the central nervous system following relatively high inhalation exposures (EPA 1989b, 1989c). *n*-Heptane was suspected to have the potential to cause peripheral neuropathy because of its structural similarity to *n*-hexane and because it is metabolized, although to a much lesser extent, to the same type of metabolite (a γ-diketone) as is thought to mediate the neurotoxicity of *n*-hexane. The available human occupational and animal experimental studies, however, give no clear evidence that *n*-heptane causes peripheral neuropathy (EPA 1989b). Methylcyclohexane caused renal effects (medullary mineralization and papillary hyperplasia) in male but not in female rats or in other species exposed for 1 year by inhalation followed by an observation period; this study is the basis for an RfC derived by EPA (1997a). The renal effect appears to be associated with $\alpha_{2\mu}$-globulin nephropathy and, therefore, may be of questionable significance to human health. Both these compounds have been classified in Group D (not classified as to human carcinogenicity) (EPA 1989c, 1998b).

The lowest reliable LOAEL values for *n*-hexane are summarized in Figure 6-12, along with the available MRL. Because so few of the compounds in this fraction have been assessed by ATSDR, limited additional information from EPA sources and the TPHCWG (1997c) regarding commercial hexane, cyclohexane, and methylcyclohexane has been added. More detailed information is available in ATSDR (1997c) and the EPA and TPHCWG sources noted above.

Figure 6-12. Aliphatic EC_5-EC_8 Exposures Associated with Health Effects - Inhalation



Sources:

ATSDR 1999b

EPA 1989c

EPA 1997a

TPHCWG 1997b

6.2.4.2 Oral Exposure

Oral health effects information for the EC_5-EC_6 fraction is limited and is available mainly for *n*-hexane. *n*-Hexane caused peripheral neuropathy in rats given the compound subchronically and in chickens given the compound acutely and subchronically. The chicken is considered to be a valuable model for human neurotoxicity of this type. 2-Methylpentane and methylcyclopentane affected nerve conduction velocity in a subchronic study in rats, but were not as effective as *n*-hexane in that same study. Reproductive (testicular) and developmental effects have been seen in animals at higher doses of *n*-hexane than associated with neurological effects. No oral MRLs were derived for *n*-hexane because of the incompleteness of the database (ATSDR 1999b). *n*-Hexane has been classified as a Group D agent (not classifiable as to human carcinogenicity) (EPA 1989a).

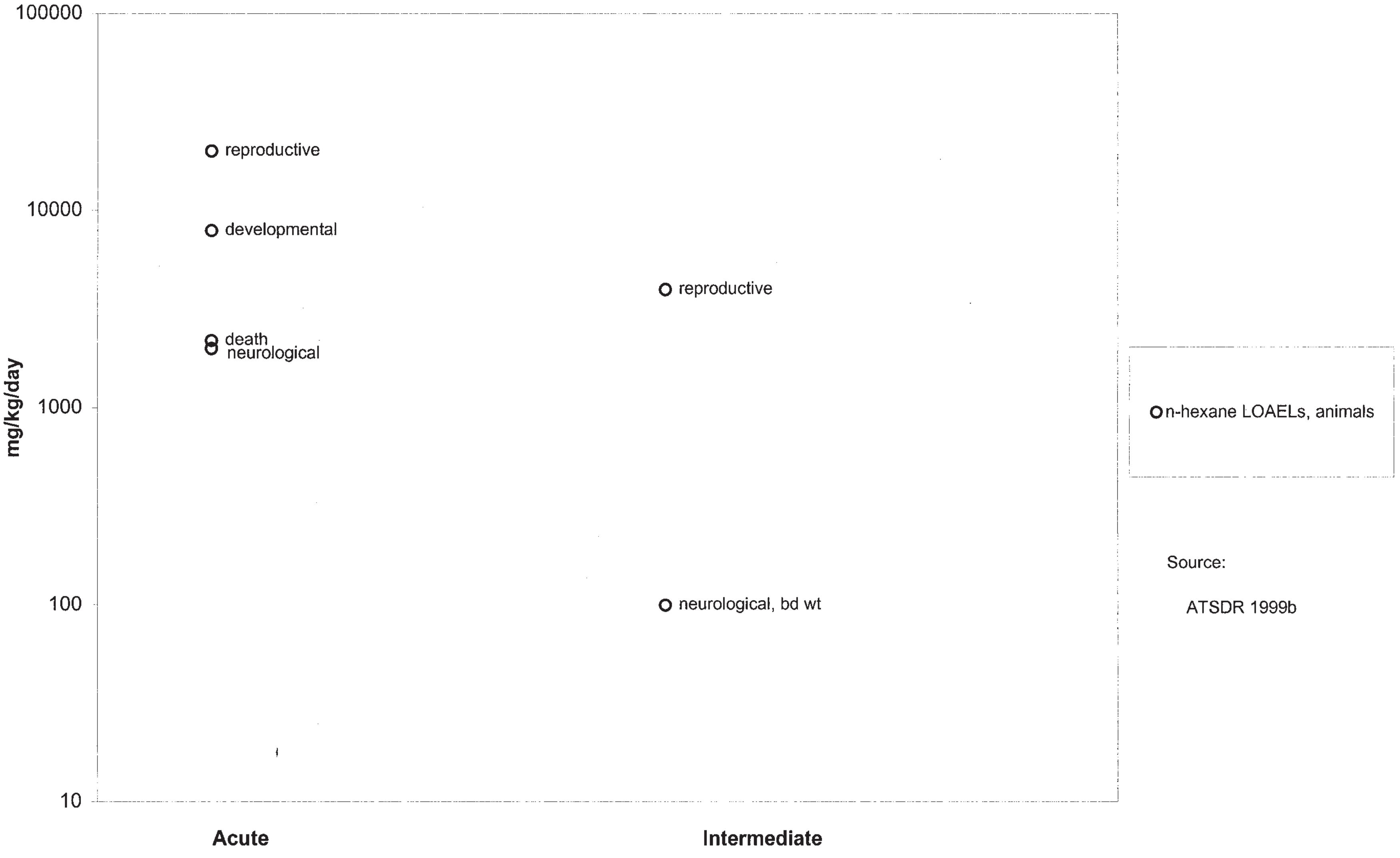
An oral 90-120-day study in rats of a commercial hexane containing 40% *n*-hexane, 24% each of 3-methylpentane and dimethylbutane, 9% cyclopentane, 2.5% cyclohexane, and 12% 2-methylpentane was conducted in comparison with *n*-hexane. This mixture includes compounds in both the EC_5-EC_6 and $EC_{>5}$-EC_8 range. Peripheral neuropathy was not seen when commercial hexane was tested at the same dose as was effective for pure *n*-hexane (ATSDR 1999b), but the dose of *n*-hexane resulting from this dose of commercial mixture was only 40% the effective dose of the pure *n*-hexane. Some evidence of carcinogenic potential has been reported in chronic inhalation studies in mice, as discussed in the previous section.

The lowest reliable LOAELs for *n*-hexane are plotted in Figure 6- 13. More detailed information, including some information on oral toxicity of related isomers and commercial hexane, is available in ATSDR (1997c).

6.2.4.3 Dermal Exposure

Some of the compounds in the combined $EC_{>9}$-EC_{16} fraction are known to be irritating to the skin and eyes, but little information is available to suggest systemic toxicity from dermal exposure.

Figure 6-13. Aliphatic EC_5-EC_8 Exposures Associated with Health Effects - Oral



Source:

ATSDR 1999b

6.2.5 Aliphatic $EC_{>8}$- EC_{16} Combined Fractions

$EC_{>8}$-EC_{10} fraction: includes *n*-nonane, *n*-decane, branched-chain C_9 -C_{10}, compounds, a few substituted cycloalkanes, and a few alkenes

$EC_{>10}$- EC_{12} fraction: includes *n*-undecane, *n*-dodecane, and pentylcyclopentane

$EC_{>12}$- EC_{16}fraction: *n*-tri-, tetra-, penta-, and hexadecane (Note that EC values for a number of branched and cyclic alkanes that potentially belong in these fractions were not listed by the TPHCWG [1997c1; see Appendix D: Table D-l for listing).

None of the individual compounds in the combined aliphatic $EC_{>8}$-EC_{16} fraction is the subject of an ATSDR toxicological profile. Some petroleum products, however, are mixtures primarily of aliphatic hydrocarbons in the range covered by this fraction. The TPHCWG (1997c) identifies JP-8 jet fuel as a mixture containing aliphatic petroleum hydrocarbons ranging from C_9-C_{16} and ATSDR has developed a toxicological profile on JP-8 (ATSDR 1998b). JP-8 contains up to 20% aromatics (C_{10}-C_{11}, $EC_{10.5}$-$EC_{12.99}$) (ATSDR 1998b; TPHCWG 1997b). Other petroleum products that are composed primarily of C_9 -C_{16}, aliphatics are JP-5, JP-7, and kerosene (fuel oil #l). These fuels also are the subjects of ATSDR toxicological profiles, and have at least one MRL (ATSDR 1995c, 1995g, 1998b). They contain approximately 16%, a maximum of 5%, and approximately 24% aromatic hydrocarbons, respectively. The jet fuels contain a number of additives such as antioxidants, metal deactivators, fuel system icing inhibitors, corrosion inhibitors, and static dissipaters. Stoddard solvent contains primarily C_9-C_{16}, aliphatics, with approximately 14% aromatics, and is also the subject of an ATSDR toxicological profile, but has no MRLs (ATSDR 1995b).

TPHCWG (1997c) also identifies a number of published and unpublished studies on dearomatized petroleum streams that correspond to portions of this range, and that contain at most 1.5% aromatics and more typically less than 0.1% aromatics. These studies on dearomatized petroleumstreams would appear to be a better basis for the assessment of health effects of this fraction, because they contain much smaller amounts of aromatics than do the petroleum products discussed in the previous paragraph and no additives. Their exact compositions and EC ranges were not reported, but EC numbers for the aliphatics tend to be close to the actual carbon numbers.

6.2.5.1 Inhalation Exposure

Hepatic effects are the most sensitive end points for inhalation exposure to JP-5, JP-7, JP-8, and kerosene (ATSDR 1995c, 199.58, 1998b). The available intermediate and chronic MRLs for these fuels are based on hepatic effects in animals. Neurological effects, particularly central nervous depression, have been seen in humans exposed acutely to JP-5 vapors, but exposure-effect relationships have not been established. Male rat $\alpha_{2\mu}$-globulin nephropathy occurred with exposure to JP-5 and JP-7, but this effect is not considered relevant to humans. A l-year exposure to JP-7 produced a small increase in the incidence of C-cell adenomas and kidney adenomas in male rats exposed to the vapor; the kidney adenomas may have been related to male rat $\alpha_{2\mu}$-globulin nephropathy, an effect with questionable relevance to human health.

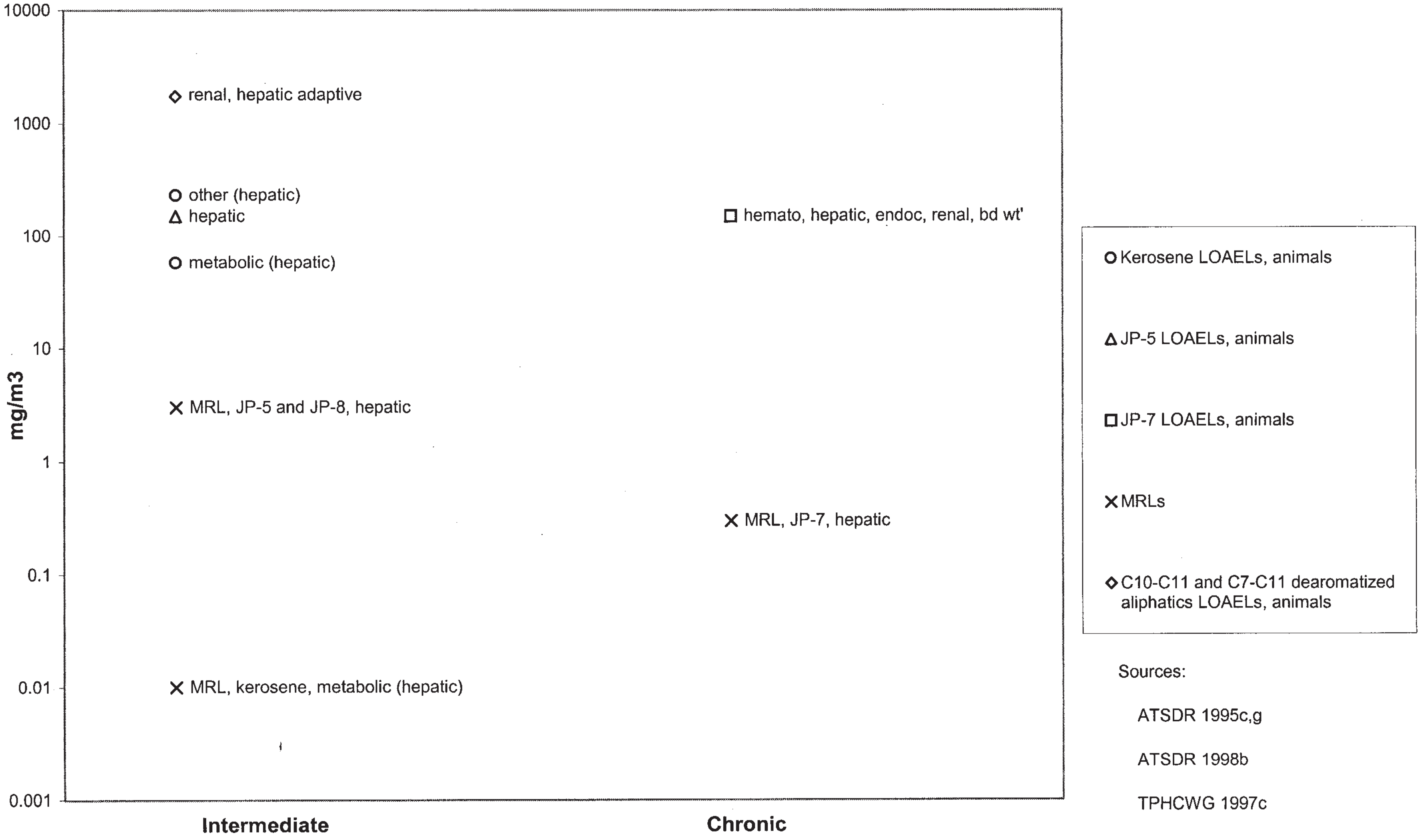
The inhalation studies of dearomatized petroleum streams included a C_{10}-C_{11} isoparaffinic solvent (branched chain alkanes), and C_7-C_{11} dearomatized white spirit (branched, straight and cyclic alkanes). Subchronic toxicity studies of these streams reported male rat nephropathy of the type that is of questionable relevance to humans health, according to the TPHCWG (1997c). In addition, increased liver weights were observed in male rats, but were said to be not significant. Developmental toxicity studies of these streams in rats revealed no developmental or maternal toxicity at the same exposure levels. These unpublished studies have been used as the basis for RfCs by the TPHCWG (1997c).

The lowest reliable LOAEL values for the jet fuels and kerosene discussed in this section are summarized in Figure 6-14, along with the available MRLs. Because these products have a significant aromatic component, limited additional information from the TPHCWG (1997c) regarding dearomatized petroleum streams has been added. More detailed information is available in the ATSDR toxicological profiles and the TPHCWG source noted above.

6.2.5.2 Oral Exposure

Oral data regarding JP-5, JP-7, JP-8, and kerosene were limited and judged inadequate for MRL development (ATSDR 19958, 1995c, 1998b). Hepatic effects and neurological effects have been seen from acute-duration oral exposure, but dose-effect relationships are either not well defined, or effects occurred at doses that also were fatal. Male rat nephropathy and decreased body weight were seen in

Figure 6-14. Aliphatic $EC_{>8}$-EC_{16} Exposures Associated with Health Effects - Inhalation



a 90-day oral study of JP-8 in male rats (Mattie et al. 1995) that was used by the TPHCWG (1997c) as the basis for an RfD, but ATSDR declined to derive an intermediate oral MRL because of the general lack of data and limitations of this study.

Subchronic studies of the dearomatized petroleum streams in rats were conducted on C_9-C_{12}, and C_{10}-C_{13} dearomatized aliphatic mixtures containing branched, straight, and cyclic alkanes, and a C_{11}-C_{17} isoparaffinic solvent containing branched and cyclic alkanes. Two of these studies reported male rat nephropathy. All three studies reported hepatic effects including hepatocellular hypertrophy and increased liver weight. Developmental toxicity was not seen at the same doses in a study of a similar mixture in rats. These unpublished subchronic studies were used as the basis for RfDs by the TPHCWG (1997c).

The lowest reliable LOAEL values for the jet fuels and kerosene discussed in this section are summarized in Figure 6-15. Because these products have a significant aromatic component, limited additional information from the TPHCWG (1997c) regarding dearomatized petroleum streams has been added. More detailed information is available in the ATSDR toxicological profiles, the TPHCWG source noted above, and Section 6.3.

6.2.5.3 Dermal Exposure

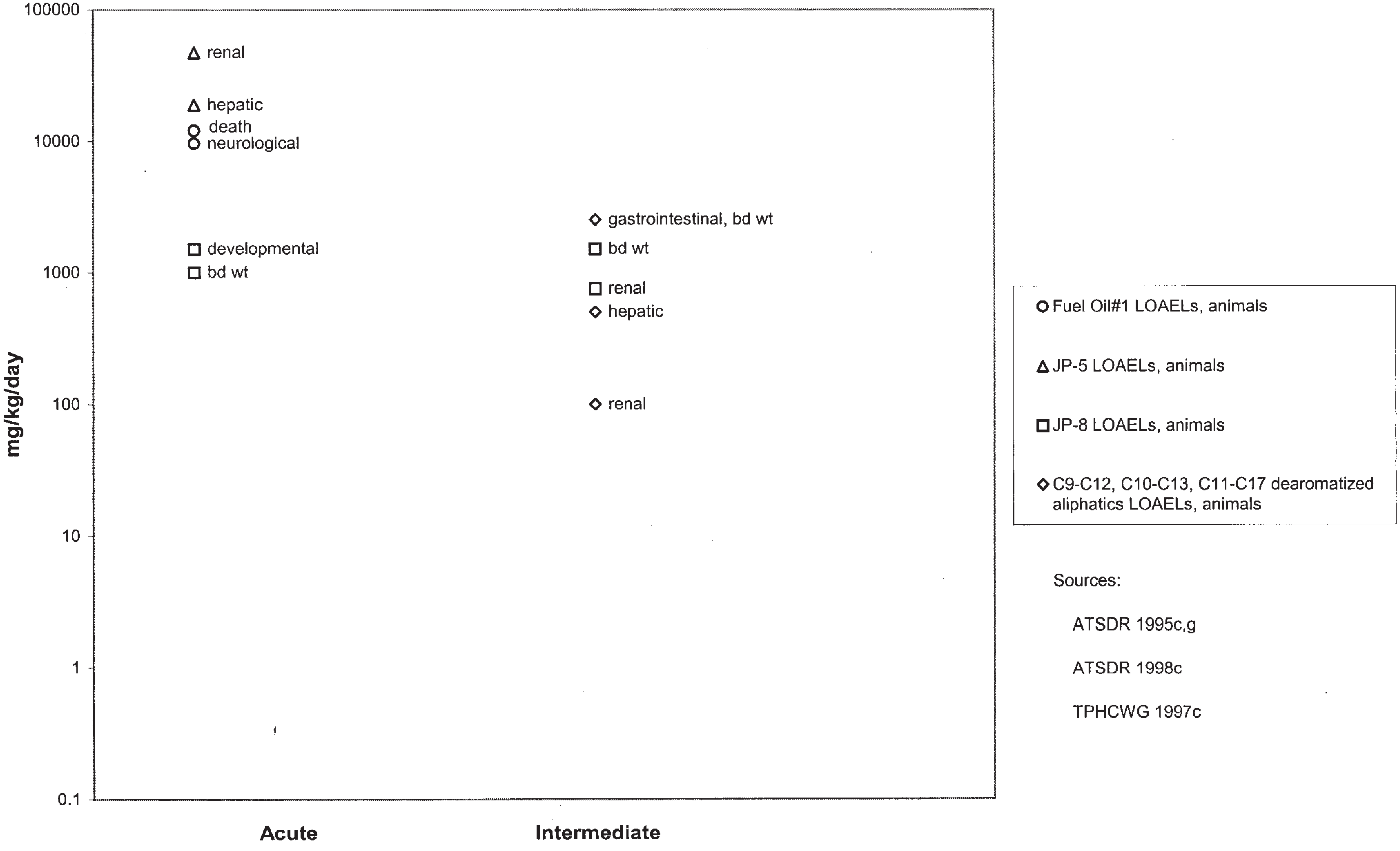
Information on the health effects of dermal exposure to JP-5, JP-7, and JP-8, and kerosene is limited. Skin and eye irritation are well documented, but effects from systemic absorption are not (ATSDR 1995c**,** 19958, 1998b).

6.2.6 Aliphatic $EC_{>16}$-EC_{35} Combined Fractions

$EC_{>16}$-EC_{21} fraction: includes *n*-hepta-, *n*-octa-, and *n*-nonadecane; and *n*-eicosadecane

$EC_{>21}$-EC_{35} fraction: includes *n*-heneicosane, *n*-docosane, *n*-tetracosane, and *n*-hexacosane.
(Note that aliphatic compounds other than the above straight-chain alkanes were not listed by the TPHCWG [1997b] as constituents of petroleum and petroleum-based fuels that are the focus of the fraction-selection approach. See Appendix D, Table D-l.) Petroleum products such as mineral-based crankcase oil and mineral-based hydraulic fluids, however, contain branched and cyclic

Figure 6-15. Aliphatic $EC_{>8}$-EC_{16} Exposures Associated with Health Effects - Oral



Sources:

ATSDR 1995c,g

ATSDR 1998c

TPHCWG 1997c

aliphatics within these equivalent carbon ranges, as do food-grade and medicinal-grade mineral oils. Although ATSDR toxicological profiles are available for mineral-based used crankcase oil and mineral-based hydraulic fluids (ATSDR 1997b, 1997c), these products contain additives and contaminants, including substantial levels of aromatics and metals (used crankcase oil) and organophosphate esters (hydraulic fluids). Little information is available regarding health effects of these products. No MRLs have been derived. The TPHCWG (1997c) has reviewed data regarding food and medicinal grade mineral oils, which are relatively pure and therefore a better choice to represent this fraction.

6.2.6.1 Inhalation Exposure

No information was located on the potential health effects of inhalation exposure to compounds or mixtures of petroleum hydrocarbons that fall within this fraction.

6.2.6.2 Oral Exposure

Purified mineral oils have been used medicinally and in foods. Subchronic toxicity studies of selected mixtures of mineral oil hydrocarbons (composed primarily of branched chain alkanes or cyclic alkanes) in F344 rats have identified the liver and the mesenteric lymph nodes as potential targets of toxicity for these mineral oils. The TPHCWG (1997c) derived chronic RfDs for low and high molecular weight mineral oils based on the hepatic effects (lipid granulomas) seen in these studies. The effect on the mesenteric lymph nodes (histiocytosis), which occurred at lower exposure levels than did the hepatic effects, was judged a nonadverse, adaptive response to the ingestion of foreign material (TPHCWG 1997c). Subchronic oral toxicity testing has also been conducted with low- and intermediate-molecular weight paraffin waxes, which contain a high proportion of straight chain alkanes and also branched alkanes and small amounts of cyclic alkanes, with C ranges primarily within this fraction range (Smith et al. 1996). Results indicate that these mixtures have toxicity similar to that of the oils for which the RfDs were derived. Strains of rats other than F344 appeared to be less sensitive to these mixtures.

Hepatic lipid granulomas have also been seen in humans exposed to mineral oils through the diet and by ingestion of medicinal mineral oils, but doses associated with the effect in humans are not known. According to TPHCWG (1997c), the granulomas in humans were circumscribed lesions with no inflammation, fibrosis, or significant liver dysfunction, whereas the granulomas in F344 rats were reactive with associated inflammation and occasional parenchymal cell necrosis.

The LOAELs identified for the "low" molecular weight mineral oils (C_{16}-C_{35}) are plotted in Figure 6-16. Additional information on health effects is provided in the review by TPHCWG (1997c).

6.2.6.3 Dermal Exposure

Information regarding health effects of dermal exposure to this fraction was not encountered in the cited source (TPHCWG 1997c).

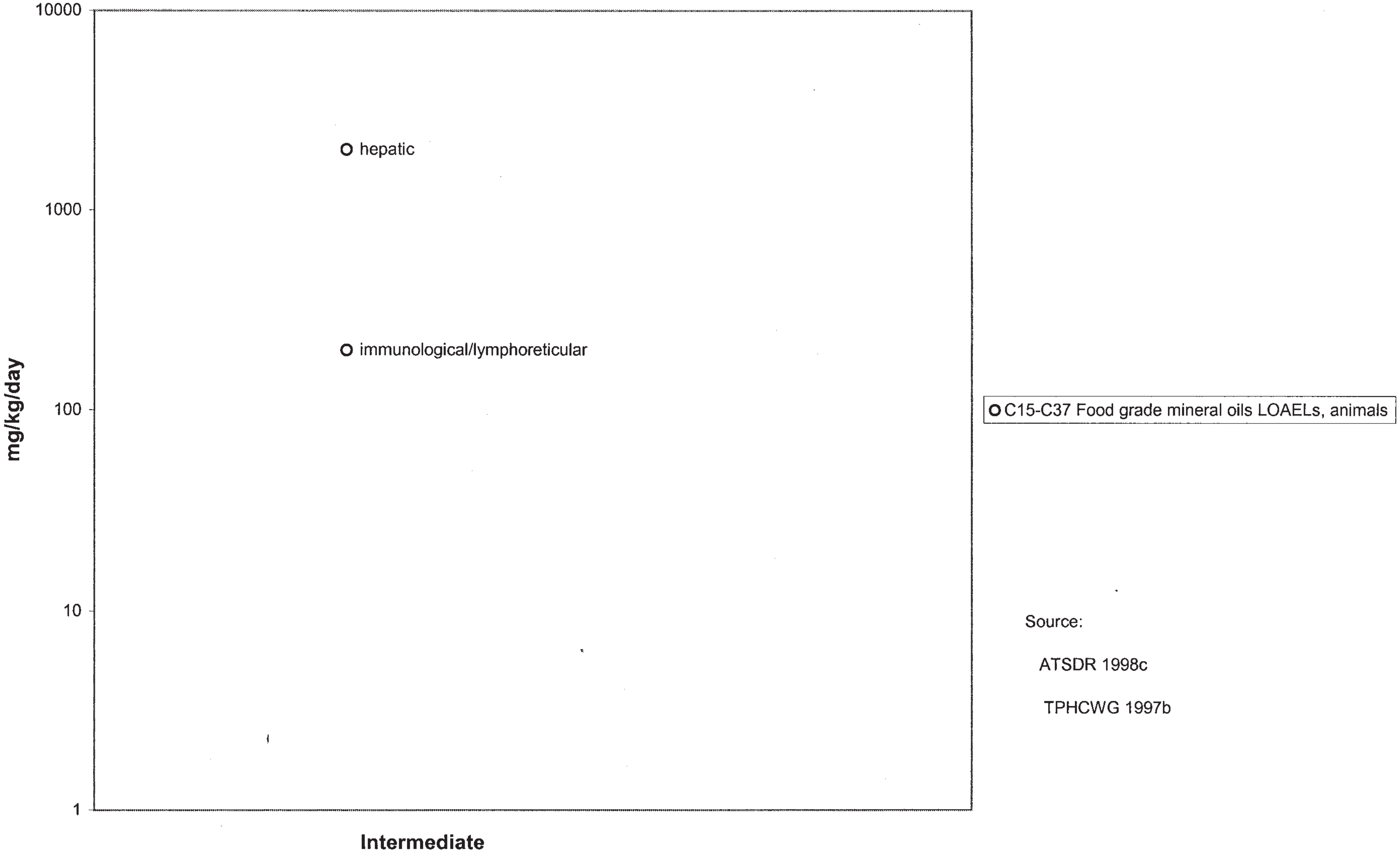
6.3 DISCUSSION OF HEALTH EFFECTS FOR WHOLE PETROLEUM PRODUCTS

Whole petroleum products are generally complex mixtures of hydrocarbons of varying carbon number and additives (usually representing a smaller weight percentage of the whole mixture) of varying chemical identities that are added to impart special qualities or enhance particular functional properties of the whole petroleum product. Additional impurities may be generated during use of the product. Non-hydrocarbon additives and impurities are not included in the definition of TPH. Toxicological information on important petroleum products that are the subjects of other ATSDR toxicological profiles, and on other petroleum products that are the subject of assessment by other agencies, is briefly reviewed in this section. Such information may be useful in characterizing acute exposure to fresh spills of petroleum products, but its usefulness is limited because of the limited availability of MRLs, the variability in the composition of petroleum products, and the change in composition due to environmental fate and transport processes. The whole petroleum products that have compositions similar to the transport fractions have been discussed in Section 6.2.

6.3.1 Jet Fuels

Jet fuels are middle distillates of petroleum crude oils that are composed of hydrocarbons generally coming off distillation columns at temperatures between 150 and 300 ºC (ATSDR 1998b; IARC

Figure 6-16. Aliphatic $EC_{>16}$-EC_{35} Exposure Levels Associated with Health Effects - Oral



Source:

ATSDR 1998c

TPHCWG 1997b

1989c). Kerosene-type jet fuels such as JP-5, JP-7, and JP-8 have the same basic composition as kerosene (consisting predominately of hydrocarbons with carbon numbers in the range of C_9-C_{16}), whereas “wide-cut” jet fuels such as JP-4 are blends of kerosene and lower-boiling naphtha streams (C_4-C_{16}). Jet fuels are refined under more stringent conditions than kerosene and contain various additives (anti-oxidants, dispersants and/or corrosion inhibitors) not found in kerosene. The exact chemical composition varies depending on the source of crude oil and additives included in the formulated product. Generally, aliphatic hydrocarbons represent the major part and aromatic hydrocarbons represent about 10-20% of kerosene and jet fuels. The benzene content of kerosenetype jet fuels is generally <0.02%, whereas “wide-cut” jet fuels typically contain more benzene (normally <0.5%). PAHs, with boiling points above 300 ºC, are generally excluded from jet fuels and kerosene.

Health effects of concern from exposure to jet fuels include eye and skin irritation from acute direct contact; respiratory, neurotoxic and gastrointestinal effects from acute accidental ingestion; and possible hepatic damage from inhalation exposure of intermediate duration as indicated by results from animal studies (ATSDR 1998b).

ATSDR (1998b) derived an intermediate-duration inhalation MRL of 3 mg/m^3 for jet fuels JP-5 and JP-8, based on a LOAEL for hepatocellular fatty changes and vacuolization in mice exposed continuously for 90 days to vapors of JP-5 at a concentration of 150 mg/m^3 (Gaworski et al. 1984). The exposure concentration was converted to a human equivalent exposure concentration (853 mg/m^3) by multiplying by the ratio of the alveolar ventilation rate divided by the body weight of mice to the same parameters for humans. The human equivalent concentration was divided by an uncertainty factor of 300 (10 for interspecies variability, 3 for intraspecies variability, and 10 for the use of a LOAEL) to derive the MRL.

ATSDR (1998b) derived no other MRLs for JP-5 or JP-8 (e.g., for acute or chronic inhalation exposures, or for oral exposures of any duration), due to the lack of data suitable for MRL derivation.

ATSDR (1995c) derived an intermediate-duration inhalation MRL of 9 mg/m^3 for JP-4 based on a LOAEL of 500 mg/m^3 for hepatic fatty degeneration in mice exposed continuously to the vapor for

90 days. The MRL was derived from this LOAEL by dosimetrically adjusting to a human equivalent concentration and applying an uncertainty factor of 300 (10 for the use of a LOAEL, 3 for interspecies extrapolation, and 10 for human variability). ATSDR (199%) derived a chronic-duration inhalation MRL of 0.3 mg/m^3 for JP-7, based on a LOAEL of 150 mg/m^3 for hepatic inflammation in rats exposed to the vapor (6 hours/day, 5 days/week) for 1 year and observed for an additional year. The MRL was calculated from this LOAEL by dosimetrically adjusting to a human equivalent continuous exposure concentration and applying an uncertainty factor of 300 (10 for the use of a LOAEL, 3 for interspecies extrapolation, and 10 for human variability).

ATSDR (199%) derived no other MRLs for jet fuels JP-4 and JP-7, due to the lack of additional suitable inhalation data and the absence of data for oral exposure to these jet fuels.

ATSDR (1995c) found no studies regarding cancer in humans exposed to the jet fuels JP-4 and JP-7. Inhalation animal studies provided no evidence that JP-7 was carcinogenic (Air Force 1991). A l-year study of rats and mice exposed by inhalation to vapors of JP-4 was identified in which increased tumors were found in the respiratory tract of female rats and mice, increased renal tumors (associated with the $\alpha_{2\mu}$-globulin nephropathy syndrome) were found only in male rats, and increased liver tumors were found in female, but not male mice (Bruner et al. 1993). ATSDR (1995c) concluded that the animal data provided equivocal evidence for the carcinogenicity of JP-4 and that there was insufficient evidence to draw conclusions regarding the carcinogenic potential of JP-4 or JP-7 in humans.

ATSDR (1998b) concluded from a review of several studies of mice dermally exposed to jet fuels (including JP-5 and Jet A) that chronic dermal application of jet fuels can act as a skin carcinogen, but noted that further investigation is needed to more fully elucidate “the impact of dermal exposure of jet fuels on humans.”

IARC (1989d) concluded that there was inadequate evidence for the carcinogenicity of jet fuel in humans and animals, but noted that there is limited evidence for the carcinogenicity in experimental animals of straight-run kerosene and hydrotreated kerosene. IARC’s review included: a cohort mortality study that found no increased cancer risk in men exposed to jet fuel, aviation kerosene, and other fuels in the Swedish Air Force; elevated risk for kidney cancer in men exposed to jet fuel in a

Canadian case-control study; and both positive and negative findings for skin cancer in studies of mice dermally exposed to jet fuels.

6.3.2 Fuel Oils

Fuel oils refined from crude petroleum can be classified either as *distillate fuels* consisting predominately of distilled process streams or as *residual fuels* consisting of residues remaining after distillation or blends of residues and distillates (ATSDR 19958; IARC 1989b). Both types of fuel oils are complex mixtures of aliphatic hydrocarbons (representing approximately 80-90% of these oils) and aromatic hydrocarbons (representing 10-20%). Light distillate fuels (e.g., fuel oil #l, straight-run kerosene) consist primarily of hydrocarbons in the C_9-C_{16}, whereas hydrocarbons in middle distillate fuels (e.g., fuel oil #2) may range from approximately C_{11}-C_{20}. Diesel fuels are similar to fuel oils with the exception that the diesel fuels contain additives. Light and middle distillate fuels generally contain less than 5% polycyclic aromatic hydrocarbons. Heavier fuel oils (e.g., fuel oil #4 and marine diesel fuel) may contain up to 15% distillation residues and more than 5% polycyclic aromatic hydrocarbons. Residual fuel oils are more complex in composition than distillate fuels, and can contain significant portions of compounds with sulfur and nitrogen.

Reports of cases of accidental ingestion of kerosene identify respiratory effects (e.g., pulmonary edema and difficulty in breathing from aspiring the liquid into the lungs), nervous system depression, and gastrointestinal irritation as effects of concern from acute exposure to fuel oils (ATSDR 1995g). These effects (and others including skin and eye irritation, and increased blood pressure) have been observed in humans in a few cases after inhalation and/or dermal acute exposures. Animal studies provide supporting data for neurological impairment from acute inhalation exposure to fuel oil #2 and hepatic effects (including decreased blood glucose levels and hepatocellular fatty changes and vacuolization) from intermediate-duration exposure to fuel oil #l and jet fuel JP-5.

ATSDR (19958) derived an acute-duration inhalation MRL of 0.02 mg/m^3 for diesel fuel (fuel oil #2) based on observations of mild transient ataxia and disturbed gait in mice exposed for 8 hours/day for 5 days to vapors of diesel fuel #2 at concentrations as low as 65 mg/m^3 (Kainz and White 1984). The LOAEL was adjusted to a continuous exposure basis and divided by an uncertainty factor of 1,000 (10 for intraspecies variability, 10 for interspecies variability, and 10 for the use of a LOAEL). ATSDR (1995g) did not discuss the potential applicability of this MRL to other fuel oils.

ATSDR (19958) derived an intermediate-duration MRL of 0.01 mg/m^3 for kerosene (also called fuel oil #l) based on a LOAEL for decreased blood glucose levels (thought to be indicative of hepatic effects) in rats exposed 6 hours/day, 6 days/week for 14 weeks to fuel oil #l at concentrations of 58 mg/m^3 (Starek and Vojtisek 1986). The LOAEL was adjusted to a continuous exposure basis and divided by an uncertainty factor of 1,000 (10 for intraspecies variability, 10 for interspecies variability, and 10 for the use of a LOAEL). ATSDR (19958) did not discuss the potential applicability of this MRL to other fuel oils, but cited, as supporting data for the MRL, findings of hepatocellular changes and vacuolization in mice exposed continuously to 150 mg/m^3 IP-5 for 90 days, and findings of no systemic or neurological effects in rats or dogs exposed to a deodorized kerosene concentration of 100 mg/m^3, 6 hours/day, 5 days/week for 13 weeks.

ATSDR (1995g) did not derive chronic inhalation MRLs or any oral MRLs (for any duration of exposure) because suitable data were not available.

From a review of available human and animal studies, ATSDR (1995g) concluded that epidemiological studies have provided “only equivocal evidence of an association between cancer and exposures to fuel oils” and that animal studies suggest that dermal exposure to fuel oils can produce skin or liver cancer. ATSDR (1995g) noted that the animal studies are restricted to one species (mice) and not all studies found carcinogenic responses. The conclusion was drawn that “further investigation utilizing other species is required to more fully elucidate the mechanism of dermal carcinogenesis and the impact of dermal exposure of fuel oils on humans.”

Based on their review, IARC (1989b) concluded that there was inadequate evidence for the carcinogenicity in humans of fuel oils; sufficient evidence for the carcinogenicity in experimental animals of residual (heavy) fuel oils; limited evidence for the carcinogenicity in experimental animals of fuel oil #2; sufficient evidence for the carcinogenicity in experimental animals of light and heavy catalytically cracked distillates, of light and heavy vacuum distillates and of cracked residues, all derived from the refining of crude oil; and limited evidence for the carcinogenicity in experimental animals of straight-run kerosene. Overall evaluations were made that residual (heavy) fuel oils are possibly carcinogenic to humans (Group 2B), and that distillate (light) fuel oils are not classifiable as to their carcinogenicity to humans (Group 3).

6.3.3 Automotive Gasoline

Gasoline is a complex mixture of volatile petroleum-derived hydrocarbons, additives, and blending agents (ATSDR 1995a; IARC 1989a). The composition of gasoline varies widely depending on the composition of the crude oil from which it is refined, the refining processes used, the type and relative amount of different petroleum refining streams blended in the finished product, and the types and amounts of nonhydrocarbon compounds added to enhance or impart specific functional properties of the gasoline. Specific market conditions, partly in response to regulations, mandate the refining and manufacturing of certain gasolines. Gasoline contains predominately hydrocarbons in the C_4-C_{12} range, with the following typical distributions: alkanes (4-8 wt%); alkenes (2-5 wt%); isoalkanes (25-40 wt%); cycloalkanes (3-7 wt%); cycloalkenes (l-4 wt%); and total aromatics (20-50 wt%). The benzene content of gasoline is 0.12-3.5% (see Table E-l .b for additional detail regarding individual hydrocarbon constituents). Additives found in gasoline include anti-knock agents (e.g., tetraethyllead), lead scavengers (e.g., 1,2-dibromoethane), detergents, anti-rust agents (e.g., sulfonates), antioxidants (e.g., p-phenylenediamine), and anti-icing agents (e.g., alcohols). Leaded gasoline is no longer allowed to be used by on-road vehicles, though it still is used in farm machinery boats, competetive vehicles, and in piston engine airplanes. (EPA 1998d). A variety of products are added to gasoline to boost octane, including ethanol and MTBE.

Acute-duration inhalation, oral, or dermal exposures to gasoline have been associated with irritation at portals of entry in humans, and high-level inhalation or oral acute exposure produces symptoms of transient neurological impairment such as headache, nausea, dizziness, euphoria, and drowsiness (ATSDR 1995a). Acute ingestion of large amounts of gasoline also produces respiratory effects such as pneumonitis and pulmonary edema due to the aspiration of gasoline. Chronic exposure to gasoline vapors by intentional inhalation also has been associated with symptoms providing evidence for more permanent neurological damage in humans such as postural tremor, abnormal gait, and affected speech. The relative degrees to which hydrocarbons and additives such as lead contribute to gasoline-induced neurological impairment are unknown. Studies with rats and mice with chronic inhalation exposure to gasoline vapors have found hepatocellular tumors in female mice, and $\alpha_{2\mu}$-globulin nephropathy and related renal tumors in male rats. The renal tumors are believed to be unique to male rats and of questionable relevance to humans.

ATSDR (1995a) derived no inhalation or oral MRLs for gasoline, “because of the variability in the composition of gasoline;” the toxicity would depend on the specific composition. ATSDR (1995a) also commented, regarding oral exposure, that there is no “quantitative information on adverse effects other than $\alpha_{2\mu}$-globulin nephropathy in male rats,” an end point that is considered “not relevant to human risk assessment.”

Numerous epidemiology studies have examined possible relationships between exposure to gasoline and development of various types of cancer in humans, but none of the studies were adequate to conclusively demonstrate that exposure to gasoline causes cancer in humans (ATSDR 1995a). The most common problems with these studies were the failure to adequately characterize exposure and the failure to control for confounding exposures to other fuels and exhaust emissions. In a chronic inhalation study, exposure to whole vapors of unleaded gasoline produced an increased incidence of renal tumors in male rats and liver tumors in female mice (MacFarland et al. 1984b). The renal tumors in male rats were considered to arise as a result of a process involving $\alpha_{2\mu}$-globulin accumulation, a process not expected to occur in humans. ATSDR (1995a) further questioned the relevance of the MacFarland findings, because the animals were exposed to whole vapors of gasoline and “gasoline emissions found in the environment contain lower concentrations of hydrocarbons with very low vapor pressures” than those found in whole vapors of gasoline.

EPA (1987c) classified gasoline as a Group B2 compound, a probable human carcinogen, based on inadequate evidence of carcinogenicity in humans and sufficient evidence in animals. This evaluation was made before EPA adopted a policy excluding $\alpha_{2\mu}$-globulin-related renal tumors in male rats from cancer weight-of-evidence classifications. EPA derived an inhalation unit risk of $2.1\text{x}10^{-3}$ ppm for gasoline based on an analysis of tumor incidence data for hepatocellular adenomas and carcinomas in female mice exposed to unleaded gasoline vapors for 2 years (MacFarland et al. 1984b). EPA has not published a more recent classification for gasoline.

IARC (1989a) concluded that there was inadequate evidence for carcinogenicity of gasoline in humans and limited evidence for carcinogenicity of unleaded automotive gasoline in experimental animals (the evidence in MacFarland et al. [1984a]). IARC (1989a) classified gasoline-as “possibly carcinogenic to humans (Group 2B),” based on the preceding conclusions and supporting data showing that gasoline induces unscheduled DNA synthesis in mice *in vivo* and in mouse, rat and human hepatocytes *in vitro;* that light, straight-run naphtha and light catalytically cracked naphtha petroleum refinery streams used to blend gasoline produce skin tumors in dermally exposed mice; ant that gasoline components such as benzene and 1,3-butadiene are known or suspected carcinogens.

6.3.4 Various Petroleum Refinery Streams

A number of health effects studies in animals of petroleum streams that correspond with the transport fractions have been reviewed by the TPHCWG (1997c); however, most of these are unpublished industry studies.

6.3.5 Stoddard Solvent

Stoddard solvent is a petroleum distillate mixture of C_7-C_{12} hydrocarbons, approximately 80-90% aliphatics (30-50% linear and branched alkanes, and 30-40% cyclic alkanes) and l0-20% aromatics (not PAHs). It is similar to white spirits, which is also included in the toxicological profile on Stoddard solvent (ATSDR 1995b). For additional detail, see Section 3.2 and Table E-2.b. Data regarding the health effects of Stoddard solvent in either humans or animals are limited and were judged inadequate for MRL development. Upper respiratory irritant effects were seen in animals exposed by inhalation for acute and intermediate durations; these appear to be the most sensitive effects by the inhalation route. Male rat nephropathy has been reported in intermediate inhalation studies, but is not considered relevant to human health. No oral studies were located. Information on the potential carcinogenicity of Stoddard solvent is inadequate.

6.3.6 Mineral-Based Crankcase Oil

Mineral-based crankcase oil is a petroleum product that is a complex mixture of low and high molecular weight (C_{15}-C_{50}) aliphatic and aromatic hydrocarbons, metals, and additives. The chemical composition of mineral-based crankcase oil varies widely, depending on the original crude oil, the processes used in refining, the types of additives included in the oil, the efficiency and type of engine in which it is used, the type of fuel used in the engine, and the length of time the oil was used in an engine. The hydrocarbon constituents are mainly straight and branched chain alkanes, cycloalkanes, and aromatics (see Table E-5.b for additional detail). Additives (which can account for-up to 20% of the weight of oil formulations) include detergents, metallic salts (e.g., molybdenum and zinc salts), and organometallic compounds. Metals (e.g., cadmium, lead and zinc) and PAHs have been demonstrated to increase in oil with continued use in an engine.

Studies examining petroleum-stream stocks used to formulate mineral-based crankcase oil indicate that these stocks are nontoxic relative to used crankcase oils; therefore, the toxicity of used oils has been attributed to additives present in the oil or to decomposition products or contaminants that accumulate in the oil with use (ATSDR 1997c). Studies of mechanics and auto-workers exposed to used mineral-based crankcase oil found elevated incidence of skin rashes, anemia, headaches and tremors, but these studies do not establish a causal relationship with exposure to used crankcase oil, due to several limitations of the studies including the likelihood that the workers were exposed to other chemicals which may have caused the effects. There are only a few toxicological studies of animals exposed to mineral-based crankcase oil. Acute exposures to mists of used mineral-based crankcase oil were irritating to the eyes and upper respiratory tract of some volunteer human subjects. Studies of rats ingesting large single doses (9,000-22,500 mg/kg) of used mineral-based crankcase oil found no adverse health effects other than diarrhea. Cattle that ingested an unknown amount of used mineral-based crankcase oil while grazing in contaminated pastures exhibited several health effects including death, anemia, and neurological dysfunction; it was postulated that the observed effects were caused by metals (molybdenum and lead) in the oil. Long-term dermal application of used mineral-based crankcase oil to the skin of mice produced an increased incidence of dermal papillomas and carcinomas and increased levels of DNA adducts associated with reactive metabolites of PAHs. The carcinogenicity of used mineral-based crankcase oil has been correlated with the PAH content of oils. ATSDR (1997e) judged that no meaningful MRL values could be derived for used mineral-based crankcase oil, due to the limitations of the toxicological data on used mineral-based crankcase oils and the wide compositional variance among used mineral-based crankcase oils.

EPA (1998b) and IARC (1996) have not classified used mineral-based crankcase oil as to its carcinogenicity in humans. IARC (1984, 1987) noted that exposure to mineral oils used in a variety of occupations (including mulespinning, metal machining, and jute processing) has been strongly and consistently associated with increased occurrence of squamous-cell cancers of the skin, especially of the scrotum, but that production processes have changed over time so that more modern, highly refined oils contain smaller amounts of “contaminants, such as polycyclic aromatic hydrocarbons.” IARC (1987) judged that there was sufficient evidence for the carcinogenicity of untreated and mildly-treated mineral oils in humans and animals, whereas there was inadequate evidence for the carcinogenicity of highly-refined mineral oils in humans or animals.

6.3.7 Mineral Oil Hydraulic Fluids

Most mineral oil hydraulic fluids are made from processed petroleum crude oils that are blended with various types of nonhydrocarbon additives to impart specific, use-related properties to the fluid (ATSDR 1997b). The carbon number range of hydrocarbons in hydraulic fluids varies depending on the intended application of the fluid, but mostly is in the range of C_{15}-C_{50}. Toxicity data for mineral oil hydraulic fluids are restricted to acute lethality studies of rats exposed by gavage or by inhalation to several types of mineral oil hydraulic fluids, and single-dose gavage neurotoxicity tests that found no effects in chickens.

ATSDR (1997b) did not derive inhalation or oral MRLs for mineral oil hydraulic fluids for any duration of exposure, because of the lack of suitable data.

IARC (1984) reviewed the evidence that certain types of mineral oils are carcinogenic in animals, whereas other types are not. IARC (1984) concluded that mineral oil is not classifiable as to its carcinogenicity, because of the apparent dependence of mineral oil’s carcinogenic activity in animals on the chemical makeup of the crude oil starting material, the presence of additives and the conditions of use.

6.3.8 Asphalt

Asphalts are complex mixtures containing relatively high molecular weight hydrocarbons, predominantly cyclic alkanes and aromatic compounds (IARC 1985). They also contain some sulfur-, nitrogen- and oxygen-containing compounds and heavy metals. They are viscous liquids or solids. Inhalation studies of these mixtures in animals have involved heating the materials to produce fumes, which is relevant to human occupational exposure (e.g., roofing, road surfacing), but not particularly relevant to exposure resulting from contamination at hazardous waste sites. Respiratory effects were seen in these studies. Respiratory effects were reported in workers who were exposed to fumes of asphalts. No oral studies were reported. IARC concluded that there is sufficient evidence that extracts of asphalts (applied to the skin of experimental animals in solvents such as benzene or toluene or injected subcutaneously) are carcinogenic to animals. Evidence for undiluted asphalts ranged from limited to inadequate, depending on type of asphalt. IARC (1985) concluded that there is inadequate evidence that asphalts alone are carcinogenic to humans

6.3.9 Crude Oil

ATSDR has not prepared a toxicological profile on crude oil. IARC (1989c) prepared a monograph on crude oils, from which the following information is summarized. Crude oils are exceedingly complex mixtures that vary greatly depending on their source. The bulk of chemicals in crude oils are hydrocarbons: straight, branched and cyclic alkanes; and aromatics including benzene, alkylbenzenes, naphthalenes and PAHs. Non-hydrocarbon constituents of crude oil include sulfur-, nitrogen-, oxygen-and metal-containing compounds.

No studies of potential health effects from inhalation exposure were located. Acute oral administration of crude oil to animals has resulted in hepatic effects and development effects. Aspiration of crude oil by a laborer resulted in pneumonia and hepatic and renal effects. Petroleum field workers who had direct dermal contact with crude oil developed adverse dermal effects, including dryness and hyperkeratosis.

A number of studies of the carcinogenicity of dermal application of crude oil to animals have been reviewed by IARC (1989c), which concluded that there is limited evidence for the carcinogenicity of crude oil to experimental animals. A cohort study of U.S. petroleum-producing and pipeline workers, and case control studies that included exposure during crude oil exploration and production, were evaluated by IARC (1989c), which concluded that there is inadequate evidence for the carcinogenicity of crude oil in humans.

An additional monograph on occupational exposures in petroleum refining (IARC 1989e) concluded that there is limited evidence that working in petroleum refineries entails a risk of skin cancer and leukemia. Exposures during refining, however, are not particularly relevant to exposures resulting from contamination of hazardous waste sites with crude oil.

6.4 TOXICOKINETICS

Overview. Because TPH is a broadly defined entity consisting of complex mixtures of hydrocarbons of varying chemical composition (due to differences in original petroleum products and differential, time-dependent, fate and transport of components within any particular TPH mixture), this section discusses available information for absorption, distribution, metabolism and excretion of components and petroleum products corresponding to the transport fractions of TPH. Limited additional information regarding the more heterogenous whole petroleum products can be found in the ATSDR toxicological profiles and other assessments of these products referenced in Section 6.3. In general, however, there is little information regarding toxicokinetics of these heterogeneous products and the discussions often deal with the individual constituents, including additives and impurities that are not petroleum hydrocarbons, and hydrocarbon mixtures that are similar to portions of the product.

Hydrocarbons in the aromatic ***$EC_{>9}$ –EC_{16}, fraction*** may be readily absorbed following inhalation or oral exposure, based on studies with humans and animals exposed to the BTEXs. BTEXs are absorbed by the skin to a lesser extent, especially with exposure to vapors. BTEXs and their metabolites are widely distributed throughout tissues and organs following absorption. BTEXs are metabolized (via oxidative metabolic pathways involving cytochrome P-450 oxidases and conjugation reactions with glucuronides, sulfates, glutathione, or amino acids) to more water-soluble metabolites that are excreted predominately in urine. Metabolism represents a toxification pathway for some effects of certain BTEXs (e.g., cancer and hematopoietic effects appear to be caused by reactive metabolic intermediates of benzene) and a detoxification pathway for other effects (e.g., neurological effects from acute exposure to toluene). In addition to urinary excretion of metabolites, BTEXs are eliminated by exhalation of unchanged parent compound and fecal excretion (ATSDR 1994, 1995d, 1997a, 1999a).

Hydrocarbons in the aromatic ***$EC_{>9}$ –EC_{16} fraction*** may be absorbed following inhalation, oral, or dermal exposure, based on studies of humans and animals exposed to cumene, naphthalene or monomethyl-naphthalenes, but data concerning the rate and extent of absorption are limited. Animal studies indicate that these indicator compounds and their metabolites are widely distributed following absorption and that urinary excretion of metabolites is the primary route of elimination. Metabolism of cumene, naphthalene, and methyl naphthalenes involves *aromatic ring oxidation* (especially for naphthalene)-forming epoxide, alcohol, dihydrodiol, and quinone derivatives that can be conjugated to glutathione, glucuronic acid, or sulfate-and *oxidation of the alkyl side groups* (i.e., in cumene or methyl naphthalenes)-forming alcohol and carboxylic acid derivatives that can be conjugated to glucuronic acid or amino acids (ATSDR 1995e; EPA 1987a, 1997b).

Hydrocarbons in the aromatic ***$EC_{>16}$ –EC_{35} fraction*** may be absorbed to varying extents following inhalation, oral, or dermal exposure, depending on the lipophilicity and molecular size of the compound and the vehicle of administration, as indicated by studies of humans exposed to workplace-air complex mixtures containing PAHs (i.e., hydrocarbons with more than two 5- or 6-carbon aromatic rings) and studies of animals exposed to individual PAHs by inhalation, oral administration, or dermal application. Increasing lipophilicity of vehicles or of the PAH compound tends to increase absorption, whereas adsorption to particles of increasing size (especially for inhalation exposure) or increasing molecular weight of the PAH compound tends to decrease absorption. Following absorption, PAHs are widely distributed to tissues and organs and eliminated by urinary and biliary excretion of metabolites. Metabolism of PAHs involves the production of arene oxides, phenols, quinones, dihydrodiols (i.e., diols), phenol-diols, and diol-epoxides, and the conjugation of these oxidized intermediates to glutathione, glucuronic acid or sulfate. Reactive metabolic intermediates, including stereospecific isomers of arene oxides and diol-epoxides, are thought to cause the genotoxic and carcinogenic effects produced by carcinogenic PAHs (ATSDR 1995f).

Hydrocarbons in the aliphatic EC_5 –EC_8 fraction may be readily absorbed in the lungs, as indicated by studies of humans and animals exposed to *n*-hexane, but absorption by the oral and dermal route is not well characterized. Aspiration to the lungs can occur following ingestion of hydrocarbons in this fraction. Absorbed *n*-hexane, based on determined partition coefficients in human and animal tissues, is expected to be widely distributed to tissues and organs with preferential partitioning into fatty tissues and well perfused tissues. Studies with humans and animals indicate that *n*-hexane is oxidatively metabolized to alcohol, ketone, carboxylic acid, dihydrodiol, and diketone derivatives, predominately in the liver. Urinary excretion of metabolites and, to a lesser extent, exhalation of unchanged *n*-hexane are the predominant means of elimination with low-level exposure, whereas exhalation of unchanged compound becomes a more important elimination pathway with high exposures (ATSDR 1999b).

Hydrocarbons in the aliphatic $EC_{>8}$ –EC_{16} fraction may be readily absorbed in the lungs, widely distributed to tissues with preferential distribution and accumulation occurring in fatty tissues, and slowly eliminated from fatty tissue, as indicated by studies of humans exposed by inhalation to a mixture of C_{10}-C_{12} alkanes (“white spirit”) and studies of rats exposed by inhalation to single alkanes or cycloalkanes in the C_6-C_{10} range. Results from these studies suggest that metabolism of hydrocarbons in this fraction, especially following distribution to fatty tissue, may be slow relative to aromatic hydrocarbons. Aspiration to the lungs may occur following ingestion of hydrocarbons in this fraction, especially those at the lower end of the ranges of molecular weight and viscosity for the fraction. Studies with rats indicate that percentage absorption of ingested aliphatic hydrocarbons decreases with increasing carbon number from about 60% for C_{14} compounds to 5% or less for hydrocarbons with 228 carbons.

Hydrocarbons in the aliphatic $EC_{>16}$ –EC_{35} fraction may be poorly absorbed, regardless of the route of exposure, preferentially distributed to the liver and fatty tissues, slowly metabolized to fatty acids or triglycerides, and slowly excreted in the feces via the bile and as urinary metabolites, as indicated by studies with animals exposed to food-grade mineral oil or motor oil (ATSDR 1997b). The common presence of lipogranulomata in human autopsies (benign structures in human liver and spleen tissue which are composed of lipoid droplets surrounded by lymphocytes and macrophages and caused by dietary exposure to mineral oils) is consistent with the concept that aliphatic hydrocarbons in this fraction are slowly metabolized.

6.4.1 Absorption

6.4.1.I Inhalation Exposure

Aromatic EC_5 –EC_9 Fraction. Studies with humans and animals are available for each of the BTEXs; these studies indicate that BTEX compounds are rapidly and efficiently absorbed following inhalation exposure. Published retention percentages for inspired BTEXs in human studies range from approximately 30% to 70-80% (see ATSDR 1994, 1995d, 1997a, 1999a).

Aromatic $EC_{>9}$ –EC_{16} Fraction. Studies measuring the rate and extent of absorption in humans or animals following inhalation exposure to naphthalene or the monomethyl naphthalenes were not available, but observations of systemic health effects in humans and animals provide qualitative evidence of absorption of these indicator compounds (ATSDR 1995e). Studies of humans following inhalation exposure to isopropylbenzene (cumene) indicated a retention percentage of about 50% (EPA 1987a, 1997b).

Aromatic $EC_{>16}$ –EC_{35} Fraction. Studies directly measuring the rate and extent of absorption in humans or animals following inhalation exposure to PAHs were not available, but measurement of the appearance of radioactivity in blood, tissues, and excreta within hours of exposure of animals to airborne, radioactively labeled benzo(a)pyrene indicate that rapid absorption can occur. Particle size and vehicle are expected to influence the absorption of inhaled PAHs, as indicated by measurements of lung clearance following inhalation exposure of rats to benzo(a)pyrene adsorbed onto particles of differing sizes and measurements of excretion rates in rats following intratracheal instillation of benzo(a)pyrene in various vehicles (ATSDR 1995f)

Aliphatic EC_5 –EC_8 Fraction. Studies with humans exposed to vapors of *n*-hexane indicate that 20-25% of inhaled compound is absorbed and retained (ATSDR 1999b). In studies with rats exposed by inhalation, 12 hours/day for 3 days, to 100 ppm single hydrocarbons in the C_6-C_{10} alkane series (*n*-hexane through *n*-decane) and a C_6-C_{10}, naphthene series (cyclohexane, methylcyclohexane, dimethylcyclohexane, trimethylcyclohexane and *t*-butylcyclohexane), absorption was demonstrated by the measurement of concentrations of hydrocarbons in blood, brain, liver, kidneys, and fat (Zahlsen et al. 1992). Within each series, tissue concentrations (μmol/kg) generally increased with increasing carbon number.

Aliphatic $EC_{>8}$ –EC_{16} Fraction. Hydrocarbons in this fraction may be readily absorbed following inhalation, as indicated by studies of humans exposed to airborne mixtures of mostly C_{10}-C_{12} hydrocarbons and by the studies of rats exposed to single hydrocarbons conducted by Zahlsen et al. (1992).

For human volunteers exposed by inhalation to 100 ppm white spirit for 3 hours, a mean pulmonary uptake of 392 mg white spirit was measured, based on concentrations of white spirit in inspiratory and expiratory air (Pedersen et al. 1987). Following exposure to the same concentration, 6 hours/day for 5 consecutive days, the mean pulmonary uptake was 3,464 mg white spirit. The test material was a mixture of aliphatic hydrocarbons containing 99% linear and branched alkanes (0.99% C_8-$C_{9,}$ 15% $C_{10,}$ 39% C_{11}, and 44% C_{12}), and 1% C_9-C_{10} cycloalkanes.

Absorption of inhaled hydrocarbons in the lower range of this fraction was demonstrated by detection of hydrocarbons in blood, brain, liver, kidneys, and fat in rats following exposure to single hydrocarbons (C_6 -C_{10}, *n*-alkanes [*n*-hexane through *n*-decane] and C_6-C_{10}, naphthenes [cyclohexane, methylcyclohexane, dimethylcyclohexane, trimethylcyclohexane, and *t*-butylcyclohexane]) at 100 ppm, 12 hours/day, for 3 days (Zahlsen et al. 1992).

Aliphatic $EC_{>16}$ –EC_{35} Fraction. Studies measuring the rate and extent of absorption of aliphatic hydrocarbons in this fraction were not located, but animal studies with mineral oil aerosols suggest that absorption is not rapid and lung clearance may be mediated by macrophages. Mice, rats, and rabbits exposed to aerosols of diesel-engine lubricating oil for up to 343 days showed oil in alveolar macrophages, mediastinal lymph nodes, lymphatic channels of the lungs, and the pleura; in mice, concentrations (w/w) of oil were 0.13% in lungs and 0.03% in livers (ATSDR 1999b).

6.4.1.2 Oral Exposure

Aromatic EC_5 –EC_9 Fraction. Animal studies are available for each of the BTEXs, indicating that these compounds are rapidly and efficiently absorbed following oral exposure. Published absorption percentages for oral doses of BTEXs in animal studies range from about 80% to 97% (see ATSDR 1994, 1995d, 1997a, 1999a).

Aromatic $EC_{>9}$ –EC_{16} Fraction. No data regarding the extent or rate of absorption of ingested naphthalene or monomethyl naphthalenes were available, except for a report that 80% of an oral dose of 2-methyl naphthalene was recovered as metabolites in the urine of rats within 24 hours (ATSDR 1995e). Studies with animals indicate that orally administered isopropylbenzene (cumene) rapidly appeared in the blood and that 90% of the administered dose was accounted for in urinary metabolites (EPA 1987a, 1997b).

Aromatic $EC_{>16}$ –EC_{35} Fraction. Studies with animals following oral exposure to benzo(a)pyrene and other PAHs indicate that the extent of oral exposure to PAHs can vary depending on lipophilicity of the PAH compound and lipophilicity of the vehicle in which it is administered (ATSDR 1995f).

Aliphatic EC_5 –EC_8, $EC_{>8}$ –EC_{16}, and $EC_{>16}$ –EC_{35} Fractions. No studies were located regarding absorption of hydrocarbons in these fractions after oral exposure in humans. Studies in rats show that absorption of ingested aliphatic hydrocarbons (*n*-alkanes, isoparaffins, and naphthenes) is inversely related to molecular weight, ranging from complete absorption at the lower end of the molecular weight range to about 60% for C_{14} hydrocarbons, 5% for C_{28} hydrocarbons, and essentially no absorption for aliphatic hydrocarbons with >32 carbons (Albro and Fishbein 1970; Miller et al. 1996)

6.4.1.3 Dermal Exposure

Aromatic EC_5 –EC_9 Fraction. Studies with animals indicate that BTEXs are dermally absorbed, but to a lesser extent than absorption via inhalation or oral exposure, especially when exposure is to vapors of these compounds (as opposed to the liquids or liquid solutions) (see ATSDR 1994, 1995d, 1997a, 1999a).

Aromatic $EC_{>9}$ –EC_{16} Fraction. Data regarding the rate and extent of dermally administered isopropylbenzene (cumene), naphthalene, or monomethyl naphthalenes were restricted to observations of systemic effects in humans and animals following dermal exposure to these compounds (ATSDR 1995e; EPA 1987a, 1997b).

Aromatic $EC_{>16}$ –EC_{35} Fraction. Studies that monitored radioactivity in rat tissues, organs, and excreta following the dermal application of individual radiolabeled PAHs in an organic solvent measured absorption percentages in the approximate range of 50-80% (% of applied dose that was absorbed), but found that absorption percentages declined to less than 20% when soil particles were included in the applied material (ATSDR 1995f).

Aliphatic EC_5 –EC_8 Fraction. *In vitro* studies with human skin indicate that the permeability of *n*-hexane through skin was about l00-fold lower than the permeability of benzene, suggesting that hydrocarbons in this fraction may have a low potential for skin absorption (ATSDR 1999b).

Aliphatic $EC_{>8}$ –EC_{16} Fraction. No studies were located regarding absorption of hydrocarbons in this fraction after dermal exposure in humans or animals.

Aliphatic $EC_{>16}$ –EC_{35} Fraction. No studies were located that measured the rate or extent of dermal absorption of hydrocarbons in mineral oil or similar materials in animals or humans. Dermal absorption of hydrocarbons in this fraction, however, may be expected to be slow, based on studies with monkeys administered subcutaneous doses of radiolabeled mineral oil in an aqueous emulsion. Radioactivity remaining at the sites of injection accounted for 85-99% and 25-33% of the administered radioactivity, at 1 week and 10 months following injection, respectively (ATSDR 1997b).

6.4.2 Distribution

Aromatic EC_5 –EC_9 Fraction. Studies with humans and animals exposed predominately to vapors of individual BTEXs (there are fewer data for oral and dermal exposure) indicate that, following absorption, compounds in this fraction are widely distributed, especially to lipid-rich and highly perfused tissues (see ATSDR 1994, 1995d, 1997a, 1999a). Studies of rats exposed by inhalation to single hydrocarbons at 100 ppm, 12 hours/day, for 3 days found that C_6-C_{10} aromatics (benzene, toluene, xylene, trimethylbenzene, and *t*-butylbenzene), compared with C_6-C_{10}, *n*-alkanes (*n*-hexane through *n*-decane) and C_6-C_{10}, naphthenes (cyclohexane, methylcyclohexane, dimethylcyclohexane, trimethylcyclohexane, and *t*-butylcyclohexane), showed high concentrations (μmol/kg) in blood, low concentrations in organs, and a lower potential for accumulation in fat and other organs presumably due to faster metabolic disposition (Zahlsen et al. 1992).

Aromatic $EC_{>9}$ –EC_{16} Fraction. Studies of swine after oral exposure to naphthalene, rats after dermal exposure to naphthalene, and guinea pigs after oral exposure to 2-methyl naphthalene indicate that these compounds, and their metabolites, are distributed throughout tissues and organs following absorption (ATSDR 1995e). Studies with rats exposed to isopropylbenzene (cumene) by inhalation, oral administration, or intravenous injection indicated that absorbed isopropylbenzene (cumene) is distributed to many tissues and organs with some preferential distribution in fatty tissues (EPA 1987a, 1997b).

Aromatic $EC_{>16}$ –EC_{35} Fraction. Studies with animals exposed to individual radiolabeled PAHs by inhalation, oral administration, or dermal administration indicate that, following absorption, PAHs are widely distributed to tissues and organs (ATSDR 1995f). Studies with pregnant animals found that, following oral exposure to radiolabeled benzo(a)pyrene, placental levels of radioactivity were higher than levels in embryonic tissue, suggesting that benzo(a)pyrene does not readily cross the placental barrier (ATSDR 199%).

Aliphatic EC_5 –EC_8 Fraction. Determination of partition coefficients (blood:air and tissue:air) for *n*-hexane in human and rat tissues indicates that hydrocarbons in this fraction, once absorbed, will be widely distributed to tissues and organs with preferential distribution to fatty tissues and well perfused tissues (ATSDR 1999b). Asphyxia and chemical pneumonitis can be a health concern from ingestion of hydrocarbons in this fraction, due to aspiration to the lungs. The aspiration potential of ingested hydrocarbons increases with decreasing viscosity; within the alkane series, C_6-C_{10}, viscosity decreases with decreasing molecular weight (Cavender 1994).

Studies of rats exposed by inhalation to single hydrocarbons at 100 ppm, 12 hours/day, for 3 days found that C_6-C_{10} *n*-alkanes (*n*-hexane through *n*-decane) and C_6-C_{10} naphthenes (cyclohexane, methylcyclohexane, dimethylcyclohexane, trimethylcyclohexane, and *t*-butylcyclohexane), compared with C_6-C_{10} aromatics (benzene, toluene, xylene, trimethylbenzene, and *t*-butylbenzene), generally showed low concentrations (µmol/kg) in blood, high concentrations in brain and other organs, and a high potential for accumulation in fat (Zahlsen et al. 1992). Within any of these three categories of hydrocarbons, hydrocarbon concentrations in tissues (blood, brain, kidney, liver and fat) generally increased with increasing carbon number (Zahlsen et al. 1992). Twelve hours after cessation of exposure, concentrations of alkanes and naphthenes in fat and brain were 2- to 3-fold higher than concentrations of aromatics, suggesting faster metabolic disposition for the aromatics.

Aliphatic $EC_{>8}$ –EC_{16} Fraction. Studies of rats exposed by inhalation to individual C_6-C_{10}, *n*-alkanes and cycloalkanes indicate that hydrocarbons in this fraction are distributed widely to tissues and organs after absorption and can accumulate in fat (Zahlsen et al. 1992). Aspiration to the lungs can occur following ingestion of hydrocarbons in this fraction (Cavender 1994). Following absorption from the gastrointestinal tract, smaller molecular weight aliphatic hydrocarbons and/or their metabolites are transported in the body via the blood and the lymph system, whereas larger molecular weight aliphatic hydrocarbons may be distributed predominately via the lymph system (see for review Albro and Fishbein 1970; Miller et al. 1996).

Aliphatic $EC_{>16}$ –EC_{35} Fraction. Lung accumulation of hydrocarbons from this fraction is of concern with prolonged or high-level exposure to aerosols or ingestion, as indicated by numerous case reports of lipoid pneumonia in humans exposed to mineral oil through intranasal application of liquid petrolatum in medicinal nose drops and by a case of lipoid pneumonia in a child who ingested a 5-10 mL dose of mineral oil automobile transmission fluid (ATSDR 1997b). Following absorption, hydrocarbons in this fraction may be expected to accumulate to some degree in liver and fatty tissues, as indicated by the observation that, 24 hours after administration of an oral dose of tritiated mineral oil to rats, concentrations of tritiated mineral oil were about 7-fold greater in fatty tissues and liver than in kidney and brain (ATSDR 1997b). Lipogranulomata (clusters of lipoid droplets surrounded by lymphocytes and macrophages) are commonly found in human autopsies, particularly in liver, spleen, and abdominal lymph nodes (Miller et al. 1996; Wanless and Geddie 1985). These structures are associated with dietary exposure to mineral oils and waxes, and are considered a benign response without adverse consequences (Miller et al. 1996; Wanless and Geddie 1985).

6.4.3 Metabolism

Aromatic EC_5 –EC_9 Fraction. As indicated by studies with humans and animals exposed to individual BTEXs, compounds in this fraction may be expected to be metabolized via cytochrome P-450 oxidases, either at carbons in the aromatic ring or in alkyl side groups, to metabolic intermediates that can be conjugated with glucuronides, sulfates, glutathione, or ammo acids (e.g., cysteine or glycine). The resultant oxidated metabolites or conjugated metabolites are more water-soluble than parent compounds and are subject to urinary or, in some cases, biliary excretion. Metabolism of the BTEXs can represent both a detoxification process (e.g., enhancement of the formation and excretion of hippuric acid can counteract the acute neurotoxicity of toluene in animals) and a toxification process (e.g., cancer and hematopoietic effects from chronic exposure to benzene appear to be caused by reactive metabolic intermediates) (see ATSDR 1994, 1995d, 1997a, 1999a).

Aromatic $EC_{>9}$ –EC_{16} Fraction. Studies with animals following oral, intraperitoneal, or subcutaneous administration of naphthalene or 2-methyl naphthalene indicate that ring oxidation occurs via an initial epoxide intermediate that subsequently is converted to alcohol, dihydrodiol and quinone derivatives, some of which are conjugated to glutathione, glucuronic acid, or glycine, and that the presence of alkyl side groups presents another site for oxidation and conjugation (ATSDR 1995e). Naphthol and naphthoquinone derivatives have been detected in the urine of humans following exposure to naphthalene (ATSDR 1995e). Studies with animals exposed to isopropylbenzene (cumene), and with *in vitro* animal preparations, indicate that cumene is predominately oxidized at the l- or 2-carbon of the propyl side group to form alcohol or carboxylic acid derivatives that are conjugated predominately to glucuronic acid (EPA 1987a, 1997b). A study that analyzed urinary metabolites in humans following acute inhalation exposure to cumene provided supporting data (EPA 1987a).

Aromatic $EC_{>16}$ –EC_{35} Fraction. *In vitro* studies with human tissues and *in vitro* and *in vivo* animal studies with benzo(a)pyrene and other PAHs indicate that compounds in this TPH fraction will undergo oxidative metabolism involving the production of arene oxides, phenols, quinones, dihydrodiols (i.e., diols), phenol-diols, and diol-epoxides (catalyzed by enzyme systems including cytochrome P-450 oxidases and epoxide hydrolase), and the conjugation of these intermediates to glutathione, glucuronic acid, or sulfate (ATSDR 1995f). Metabolism of PAHs facilitates both the elimination of more water soluble metabolites and the production of reactive intermediates (e.g., stereospecific isomers of arene oxides and diol-epoxides) thought to be responsible for the mutagenic and carcinogenic activity of carcinogenic PAHs (ATSDR 1995f).

Aliphatic EC_5 –EC_8 Fraction. Examination of urinary metabolites in humans and rats after exposure to *n*-hexane indicates that hydrocarbons in this fraction may be oxidatively metabolized via cytochrome P-450 oxidases to several alcohol, ketone, and carboxylic acid derivatives. Based on studies of urinary metabolites after exposure to *n*-hexane, proposed metabolites include l-, 2-, and 3-hexanol, 2-hexanone, 5-hydroxy-2-hexanone, 2,5-hexanedione, and hexanoic acid (ATSDR 1999b).

Aliphatic $EC_{>8}$ –EC_{16} Fraction. Hydrocarbons in this fraction are oxidatively metabolized to fatty acids and alcohols, apparently mediated by cytochrome P-450 isozymes (see Miller et al. 1996 for review). Studies regarding the metabolism of hydrocarbons in this fraction in humans or animals provide suggestive evidence that metabolism may be slow. In a study of humans exposed to 100 ppm white spirit 6 hours/day for 5 days (white spirit is a mixture comprised predominately of C_{10}-C_{12}, linear and branched alkanes), only minor differences were observed in the GC-MS spectrum of hydrocarbons in biopsied fatty tissue, than in the spectrum of hydrocarbons in the test material (Pedersen et al. 1984). In rats exposed by inhalation to single C_6-C_{10}, alkanes, cycloalkanes, or aromatic hydrocarbons at 100 ppm, 12 hours/day for 3 days, concentrations of alkanes and cycloalkanes were 2- to 3-fold higher than concentrations of aromatics 12 hours after cessation of exposure, suggesting that aliphatic hydrocarbons in this fraction may be metabolized more slowly than aromatic hydrocarbons of equivalent molecular weight (Zahlsen et al. 1992).

Aliphatic $EC_{>16}$ –EC_{35} Fraction. Aliphatic hydrocarbons in this fraction are not expected to undergo extensive metabolism in animals or humans. In monkeys, 2 days after intramuscular injection of a mineral oil emulsion with a radiolabeled C_{16} hydrocarbon (*n*-hexanedecane), substantial portions (30-90s) of radioactivity in various tissues existed as unmetabolized *n*-hexanedecane. The remainder of the radioactivity was found as phospholipids, free fatty acids, triglycerides, and sterol esters. No radioactivity was found in water-soluble fractions (ATSDR 1997b). The common presence of lipogranulomata in human autopsies and the widespread dietary exposure to mineral oils and waxes (Wanless and Geddie 1985) are consistent with the concept that aliphatic hydrocarbons in this fraction are slowly metabolized.

6.4.4 Elimination and Excretion

Aromatic EC_5 –EC_9 Fraction. Studies with humans and animals exposed by various routes to BTEXs, indicate that compounds in this fraction may be expected to be eliminated predominately by urinary excretion of metabolites and to lesser degrees by exhalation of unchanged parent compound or biliary excretion of metabolites (see ATSDR 1994, 1995d, 1997a, 1999a).

Aromatic $EC_{>9}$–EC_{16} Fraction. Data from studies with animals exposed by several routes to naphthalene, monomethyl naphthalenes and isopropylbenzene (cumene) indicate that urinary excretion of metabolites represents the predominant pathway of elimination for these compounds. Detection of urinary metabolites in humans exposed to naphthalene or cumene provide supporting evidence (ATSDR 1995e; EPA 1987a, 1997b).

Aromatic $EC_{>16}$ –EC_8 Fraction. Studies with animals exposed by inhalation, and by oral, dermal, or parenteral administration, indicate that PAHs are eliminated by urinary and biliary excretion of metabolites (ATSDR 1995f).

Aliphatic EC_5 –EC_8 Fraction. Studies with humans and animals exposed to *n*-hexane suggest that hydrocarbons in this fraction, under low-exposure conditions, may be eliminated predominately as urinary metabolites and to a lesser extent in exhaled air as unchanged compound. Studies with rats indicate that the importance of exhalation of unchanged hexane as an elimination pathway increased from about 12% to 62% of body burden after inhalation exposure to 500 ppm and 10,000 ppm, respectively (ATSDR 1999b).

Aliphatic $EC_{>8}$ –EC_{16} Fraction. Results from studies with humans exposed by inhalation to white spirit (a mixture of C_{10}-C_{12} aliphatic hydrocarbons) suggest that hydrocarbons in this fraction are slowly eliminated following distribution to fatty tissues (Pedersen et al. 1984). Immediately after 5 consecutive days of 6-hour daily exposure to 100 ppm white spirit, the mean concentration of white spirit in fatty tissue was 41.1 mg/kg fat; approximately 60 exposure-free hours later, mean fatty tissue concentrations had declined by only 23% to 3 1.7 mg/kg fat. No studies were located regarding the routes of excretion for hydrocarbons in this fraction in humans or animals.

Aliphatic $EC_{>16}$ –EC_{35} Fraction. Hydrocarbons in this fraction may be expected to be eliminated predominately in the feces, based on experiments with rats given oral or intraperitoneal doses of tritiated mineral oil. With oral exposure, 90% of administered radioactivity appeared rapidly (within 2 days) in the feces, predominately as unchanged mineral oil; less than 10% of administered radioactivity appeared in the urine within 2 days of administration. With intraperitoneal exposure, radioactivity appeared more slowly in the feces (11% of administered radioactivity appeared in the feces within 8 days of dosing); urinary excretion of metabolites, within 8 days of dosing, represented about 8% of administered radioactivity (ATSDR 1997b).

6.4.5 Physiologically Based Pharmacokinetic (PBPK)/Pharmacodynamic (PD) Models

No studies were located regarding the development of PBPK/PD models for complex mixtures of TPH in general.

Verhaar et al. (1997), however, recently reported on progress in developing PBPK/PD models for use in assessing human health risks from exposure to JP-5, a Navy Jet petroleum fuel containing a complex mixture of hydrocarbons in the C_9C_{18}, range. Verhaar et al. (1997) noted that their in-progress development of a PBPK/PD model for JP-5 is focused on the prediction of kinetics of JP-5 components in relevant tissues after acute inhalation exposure and the resultant toxicity (neurological effects linked to the dissolution of xenobiotic chemicals in the membrane of nerve cells). Verhaar et al. (1997) discussed how the development of PBPK/PD model(s) for complex mixtures involves:

> (1) determining a lumping scheme to be used (in which similar mixture components are grouped [i.e., lumped] into a *pseudocomponent* for which necessary chemical parameters such as tissue partition coefficients are estimated), based on knowledge of the mixture's chemical composition, the route and duration of exposure that is of interest, and the mixture's toxicological effect(s) and mechanism of action (a lumping scheme based on the octanol-water partition coefficients of components was chosen for JP-5);
>
> (2) formulating PBPK/PD model(s) with physiological compartments, reaction kinetic equations, and mass transfer equations that are appropriate to the toxicological effect(s) of concern (a brain compartment, including a pharmacodynamic subroutine, was proposed to be included in the PBPK/PD model for JP-5);

> (3) determining whether there is enough information to include interactive effects between *pseudocomponents* in the model(s); and
>
> (4) using quantitative structure-activity relationships (QSAR) to estimate necessary model parameters for *pseudocomponents* such as tissue-blood and air-blood partition coefficients, and metabolic rate constants.

The approach discussed by Verhaar et al. (1997) suggests that development of PBPK/PD models to use in assessing health risks from TPH will require similar focusing on relevant lumping schemes, exposure pathways and durations, and toxicological effects and mechanisms of action. Thus, it is likely that a PBPK/PD model developed to aid in the assessment of potential cancer risk from chronic exposure to TPH may substantially differ from a PBPK/PD model for assessing risk for potential neurological effects from acute exposure to TPH.

6.5 MECHANISM OF ACTION

Because TPH is a broadly defined entity consisting of complex mixtures of hydrocarbons of varying chemical composition (due to differences in original petroleum products and differential, time-dependent, fate and transport of components within any particular TPH mixture), this section discusses available information for components and petroleum products corresponding to the transport fractions of TPH. Limited additional information regarding the more heterogenous whole petroleum products can be found in the ATSDR toxicological profiles and other assessments of these products referenced in Section 6.3. In general, however, there is little information regarding mechanisms for these heterogenous products. The discussions of mechanisms in these documents often deal with the individual constituents, including additives and impurities that are not petroleum hydrocarbons, and with hydrocarbon mixtures that are similar to portions of the product.

6.5.1 Pharmacokinetics Mechanisms

Absorption. Available data suggest that hydrocarbons in the aliphatic EC_5-EC_5 and aromatic EC_5-EC_9 fractions may be more readily absorbed by the lungs, gastrointestinal tract, and skin than hydrocarbons in the aliphatic or aromatic hydrocarbons in larger molecular weight fractions. This difference is due to their smaller molecular size and the presumed dependence of absorption of hydrocarbons on diffusion or facilitated diffusion.

Distribution, Storage and Excretion. Hydrocarbons in each of the aliphatic and aromatic fractions are expected to be distributed throughout tissues and organs following absorption. Preferential distribution to fatty tissues occurs especially with aliphatic hydrocarbons. Ingested or inhaled volatile aliphatic and aromatic hydrocarbons in the EC_5-EC_8 and EC_5-EC_9 fractions can be eliminated in exhaled breath as unchanged parent compound. Metabolic elimination of aromatic hydrocarbons in each EC fraction predominately occurs via oxidative metabolic pathways involving initial oxidation by cytochrome P-450 isozymes and conjugation to more water-soluble compounds such as glutathione and glucuronic acid. Some studies in animals suggests that aliphatic hydrocarbons (especially in the $EC_{>8}$-EC_{16} and $EC_{>16}$-EC_{35} fractions) may be metabolized more slowly than aromatic hydrocarbons. Metabolites of both aliphatic and aromatic hydrocarbons are excreted in urine and in feces via biliary excretion.

Route-dependent Toxicity. Ingested aliphatic hydrocarbons in the EC_5-EC_8 and $EC_{>8}$-EC_{16} fractions are aspirated to the lungs and can lead to pulmonary irritation, edema, and pneumonia. Materials with low viscosity (in the range of 30-35 centipoise) present an extreme aspiration risk, whereas those with high viscosity (150-250 centipoise) present very low aspiration risk (Snodgrass 1997).

6.5.2 Mechanisms of Toxicity

Central nervous system (CNS) depression caused by acute inhalation exposure to volatile aliphatic and aromatic petroleum hydrocarbons is generally thought to occur when the lipophilic parent hydrocarbon dissolves in nerve cell membranes and disrupts the function of membrane proteins by disrupting their lipid environment or by directly altering protein conformation. Oxidative metabolism of CNS-depressing hydrocarbons reduces their lipophilicity and represents a process that counteracts CNS-depression toxicity. More detailed information on this mechanism of toxicity can be found in ATSDR profiles on toluene (ATSDR 1994), ethylbenzene (ATSDR 1999a), and xylene (ATSDR 1995d).

Pulmonary irritation and pneumonia from inhalation and oral exposure to complex mixtures of petroleum hydrocarbons such as gasoline and kerosene are thought to involve direct parent hydrocarbon interaction with nerve cell membranes resulting in bronchoconstriction and dissolution into membranes of lung parenchyma resulting in a hemorrhagic exudation of proteins, cells, and fibrin into alveoli (ATSDR 1998b; Klaassen 1996).

In contrast, metabolic bioactivation, mediated by pathways involving cytochrome P-450 isozymes, is thought to be responsible for hemolytic anemia and leukemia from exposure to benzene (ATSDR 1997a) genotoxic effects and cancer from exposure to carcinogenic PAHs (ATSDR 19950; hemolytic anemia, ocular effects, and lung effects from naphthalene and methyl naphthalenes (ATSDR 1995e); peripheral neuropathy from *n*-hexane (ATSDR 1999b); lung effects from ethylbenzene (ATSDR 1999a); and $\alpha_{2\mu}$-globulin nephropathy (which is unique to male rats) from hydrocarbons in gasoline (ATSDR 1995a).

6.5.3 Animal-to-Human Extrapolations

Rats and mice are much less sensitive than humans to the hemolytic effects of naphthalene. The dog appears to be a better model for humans for this effect (ATSDR 1995e).

Inhalation or oral exposure to a number of the individual constituents of the TPH fractions (particularly branched-chain alkanes) and also the petroleum products whose composition is similar to these fractions (e.g., JP-5, JP-7, and the dearomatized streams) induces a hydrocarbon-related nephropathy unique to male rats (ATSDR 1995c, 1995g, 1998b; TPHCWG 1997c). This lesion involves the formation of hyaline droplets in the cytoplasm of the proximal tubule cells of the cortex. The hyaline droplets contain high concentrations of the protein $\alpha_{2\mu}$-globulin, a protein found in male rats but not in humans. A likely mechanism for this accumulation is the slowing of the degradation of $\alpha_{2\mu}$-globulin as a result of binding with specific substances, such as petroleum hydrocarbons or their metabolites. Single cell necrosis and exfoliation of the proximal tubular epithelium occurs, and the tubules near the cortico-medullary junction become dilated and are eventually filled with coarsely granular casts and necrotic debris. Regenerative tubule cell proliferation and mineralization of the renal papillar tubules occurs with continued exposure. The nephropathy induced by accumulation of this protein has not been noted in female rats, in male rats that lack the ability to synthesize $\alpha_{2\mu}$-globulin, or in other species. Thus, it does not appear that the nephrotoxicity attributable to the $\alpha_{2\mu}$-globulin syndrome observed in male rats is relevant to humans.

Food grade and medicinal mineral oils which correspond to the aliphatic $EC_{>16}$-EC_{35} fraction of TPH produce liver granulomas in F344 rats. These granulomas are reactive, with associated inflammation and occasional parenchymal cell necrosis. The inflammatory effects are not seen in dogs, mice, or Long-Evans or Sprague-Dawley rats fed comparable doses of similar mineral oils, according to TPHCWG (1997c). In addition, humans, who are exposed to mineral oils in the diet and by intentional ingestion of medicinal mineral oils, develop granulomas, but without evidence of inflammation or significant liver dysfunction. Whether the exposure levels for humans are comparable to those tested in experimental animals is not known. Nevertheless, the issue has been raised that F344 rats may be uniquely predisposed to the development of inflammatory granulomatous lesions, and that this difference in sensitivity may justify use of a smaller uncertainty factor in extrapolating from the F344 rat to humans (TPHCWG 1997c).

6.6 SELECTION OF FRACTION-SPECIFIC HEALTH EFFECTS CRITERIA

6.6.1 Overview

The focus of this section is the selection, when possible, of appropriate MRLs for the assessment of health effects of the aromatic and aliphatic fractions of TPH. Approaches to cancer assessment are also discussed. The TPH fractions are environmental transport fractions, as suggested by the TPHCWG (1997c), with a slight modification to include all the BTEXs in a redefined aromatic EC_5-EC_9 fraction.

Other agencies have addressed the problem of selection of health effects criteria for fractions or representative constituents of TPH (ASTM 1995; Hutcheson et al. 1996; TPHCWG 1997c), and their approaches were carefully evaluated during the preparation of this profile, as discussed in Sections 6.1 and 6.2. Nevertheless, ATSDR’s concerns and mandate encompass a broader range of exposure periods than those of the other agencies, and ATSDR health criteria are developed somewhat differently and for a slightly different purpose. These issues were discussed in Section 6.1 and 6.2.

Tables 6-l and 6-2 summarize the suggested fraction-specific MRLs for inhalation and oral exposure. These fraction-specific MRLs are provisional values, reflecting the uncertainty inherent in this approach (see Section 6.6.2 for a more complete discussion). As with any ATSDR MRL, the MRLs in Tables 6-l and 6-2 are intended to serve as health guidance values and are not to be used to define clean-up or action levels. Information listed in brackets in Table 6-2 is from sources other than ATSDR toxicological profiles. This information indicates potentially sensitive end points but does not have the same level of confidence as information from the ATSDR toxicological profiles. Additional details and tables listing all the candidate MRLs and relevant cancer assessments are presented in Section 6.6.2. Chapter 7 also

Table 6-1. Fraction-Specific Provisional Inhalation MRLs and Critical Effects

		Acute MRL		Intermediate MRL		Chronic MRL	
Fraction	Indicator or surrogate compound or mixture	ppm	Effect	ppm	Effect	ppm	Effect
Aromatic							
EC_5–EC_9: Indicator Compounds	Benzene	0.05	Immunological/ lymphoreticular	0.004	Neurological	—	—
	Toluene	3	Neurological	—	—	1	Neurological
	Ethylbenzene	—	—	0.2	Developmental	—	—
	Xylene	1	Neurological	0.7	Developmental (neurological)	0.1	Neurological
$EC_{>9}$–EC_{16}	Naphthalene	—	—	—	—	0.002	Respiratory
$EC_{>16}$–EC_{35}	No data	—	—	—	—	—	—
Aliphatic							
EC_5–EC_8	n-Hexane	—	—	—	—	0.6	Neurological
$EC_{>8}$–EC_{16}	JP-5 and 8 JP-7	—	—	3 mg/m^3	Hepatic	0.3 mg/m^3	Hepatic
$EC_{>16}$–EC_{35}	No data	—	—	—	—	—	—

EC = Equivalent Carbon Number Index; MRL = minimal risk level

Source: Appendix A. MRLs and critical effects are summarized in Appendix A of this profile. Additional information is available in the profile for each compound (e.g., ATSDR. 1999b. Toxicological profile for hexane).

Table 6-2. Fraction-Specific Provisional Oral MRLs and Critical Effects[a]

Fraction	Indicator or surrogate compound or mixture	Acute MRL		Intermediate MRL		Chronic MRL	
		mg/kg/day	Effect	mg/kg/day	Effect	mg/kg/day	Effect
Aromatic							
EC_5–EC_9: Indicator Compounds	Benzene	—	—	—	—	—	—
	Toluene	0.8	Neurological	0.02	Neurological	—	—
	Ethylbenzene	—	—	—	—	—	—
	Xylene, mixed	—	—	0.2	Renal	—	—
	Xylene, *m*-	—	—	0.6	Hepatic	—	—
	Xylene, *p*-	1	Neurological	—	—	—	—
$EC_{>9}$–EC_{16}	Naphthalene	0.05	Neurological	0.02	Hepatic	—[a]	—
$EC_{>16}$–EC_{35}	Fluorene, fluoranthene	—	—	0.4	Hepatic	—	—
Aliphatic							
EC_5–EC_8	No data	—	—	—	—	—	—
$EC_{>8}$–EC_{16}	No ATSDR MRLs [Dearomatized petroleum streams][b]	—	—	—	[Hepatic][b]	—	—
$EC_{>16}$–EC_{35}	No ATSDR MRLs [Mineral oils C_{15}–C_{37}][b]	—	—	—	[Hepatic][b]	—	—

[a] No chronic MRL appears suitable for the assessment of health effects of the aromatic $EC_{>9}$-EC_{16} fraction as a whole, but a chronic MRL of 0.07 mg/kg/day is available for 1-methylnaphthalene.

[b] Critical effects are listed in brackets for mixtures that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purpose of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

EC = Equivalent Carbon Number Index; MRL = minimal risk level

Source: Appendix A. MRLs and critical effects are summarized in Appendix A of this profile. Additional information is available in the profile for each compound (e.g., ATSDR. 1999b. Toxicological profile for hexane).

presents MRLs for constituents and whole petroleum products and health effects criteria developed by other agencies (EPA and TPHCWG RfDs and RfCs).

6.6.2 Minimal Risk Levels, Critical Effects, and Cancer Assessments for Fractions of TPH

The information in the following text is taken from the references cited in the tables that accompany the text. For the sake of readability, the references will not be cited in the text. Additional health effects information is available in the pertinent toxicological profiles (ATSDR 1994, 1995c, 1995d, 1995e, 1995f, 1995g, 1997a, 1998b, 1999a, 1999b), TPHCWG (1997c), EPA references cited in the tables including EPA (1998b), and in Section 6.2. In order to fill data gaps, some compounds, representative mixtures, or studies that have not been assessed in ATSDR toxicological profiles are listed, with the critical or sensitive effects as evaluated by other agencies (EPA and TPHCWG) shown in brackets. This was done to give a more complete picture of the potential health effects of fraction constituents, to aid in judging whether the available MRLs may be useful in assessing health effects of the entire fraction.

Aromatic $EC_{5\text{-}9}$ Fraction: Indicator Compounds. This fraction consists of benzene, toluene, ethylbenzene and the xylenes (the BTEXs).

Inhalation Exposure. The available inhalation MRLs for each of the BTEXs, and the EPA cancer risk for benzene, can be used to assess the potential for health effects for each of these indicator compounds individually. This is consistent with current practice. These MRLs and their associated effects, as well as the EPA cancer assessments, are summarized in Table 6-3. Health effects that are common to the BTEXs are neurological effects. Developmental effects appear to be a sensitive effect of inhalation exposure to ethylbenzene and xylene. Benzene has hematological and immunological/lymphoreticular effects and is classified in EPA Group A (human carcinogen).

Oral Exposure. The oral MRLs for each of the BTEXs, and the EPA cancer risk for benzene, can be used to assess the potential for health effects for each of these compounds individually. No oral MRLs exist for ethylbenzene, but the limited oral data for this compound are reasonably similar to those for toluene. These MRLs and their associated effects, and the available EPA cancer assessments, are summarized in Table 6-4. Effects of oral exposure to these compounds are similar to those of inhalation exposure. In addition, renal and hepatic effects appear to be sensitive effects of xylene exposure.

Table 6-3. Inhalation MRLs, Critical Effects, and EPA Cancer Assessments for Aromatic EC_5–EC_9 Fraction

C	EC	Compound	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per 1 ppm[a]
				ppm	Effect	ppm	Effect	ppm	Effect	
6	6.5	Benzene	1997a	0.05	Immunological/ lymphoreticular	0.004	Neurological	–	–	A, 2.7×10^{-2}
7	7.58	Toluene	1994	3	Neurological	–	–	1	Neurological	D, NA
8	8.5	Ethylbenzene	1999a	–	–	0.2	Developmental	–	–	D, NA[b]
8	8.6–8.81	Xylene, mixed	1995d	1	Neurological	0.7	Developmental (neurological)	0.1	Neurological	D, NA

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b).

[b] EPA Classification in Group D (EPA 1998b) occurred prior to publication of chronic inhalation study of ethylbenzene (NTP 1996). ATSDR (1999a) notes that this classification is likely to change in the near future because the NTP study provides evidence of carcinogenicity (renal and testicular) in male rats and suggestive evidence in female rats and male and female mice.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

Table 6-4. Oral MRLs, Critical Effects, and EPA Cancer Assessments for Aromatic EC_5 - EC_9 Fraction

C	EC	Compound	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per mg/kg/day[a]
				mg/kg/day	Effect	mg/kg/day	Effect	mg/kg/day	Effect	
6	6.5	Benzene	1997a	–	–	–	–	–	–	A, $2.9x10^{-2b}$
7	7.58	Toluene	1994	0.8	Neurological	0.02	Neurological	–	–	D, NA
8	8.85	Ethylbenzene	1999a	–	–	–	–	–	–	D, NA[c]
8	8.6–8.81	Xylene, mixed	1995d	–	–	0.2	Renal	–	–	D, NA
8	8.6	Xylene, -*m*	1995d	–	–	0.6	Hepatic	–	–	–
8	8.61	Xylene, *p*-	1995d	1	Neurological	–	–	–	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b).

[b] Dose levels associated with excess cancer risks of 10^{-4}, 10^{-5}, 10^{-6}, and 10^{-7} have been calculated to be $3x10^{-3}$, $3x10^{-4}$, $3x10^{-5}$, and $3x10^{-6}$ mg/kg/day, respectively.

[c] EPA Classification in Group D (EPA 1998b) occurred prior to publication of a chronic inhalation study of ethylbenzene (NTP 1996). ATSDR (1999a) notes that this classification is likely to change in the near future because the NTP study provides evidence of carcinogenicity (renal and testicular) in male rats and suggestive evidence in female rats and male and female mice.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

Aromatic $EC_{>9}$-EC_{16} Combined Fraction. The combined fraction consists of the following three fractions:

$EC_{>9}$-EC_{10} : a variety of alkylbenzenes (propyl-, methylethyl, trimethyl, and branched-chain butyl)

$EC_{>10}$-EC_{12}: a few alkylbenzenes (*n*-butyl-, *n*-pentyl-, a trimethyl-, and other multisubstituted), indans, and naphthalene

$EC_{>12}$-EC_{16}: a few longer chain and multi-substituted alkylbenzenes; biphenyls, methyl naphthalenes, and some smaller PAHs.

Inhalation Exposure. A chronic inhalation MRL is available for naphthalene; this MRL is listed in Table 6-5. There are no other inhalation MRLs for this fraction. All of the compounds in this fraction that have EPA carcinogenicity assessments have been classified in group D (not classifiable as to human carcinogenicity). Given the few health effects benchmarks available for the constituents of this fraction, and the general paucity of inhalation data for this fraction (see Section 6.2.2.1), selection of surrogate values for the combined fraction is problematic. Health effects that appear to be common to the compounds in this fraction are respiratory irritant effects, neurological effects, and renal effects, but it is not clear that they are common to all, or even that adequate investigation of respiratory or neurological effects was conducted for all compounds in the table. Based on some commonality of effect, the chronic MRL of 0.002 ppm for naphthalene could be adopted as a surrogate value for the combined fraction as a provisional measure. Great uncertainties are attendant on this selection, but the alternative is to disregard the potential for health effects of much of the mass of this fraction.

Oral Exposure. The only MRLs available for this fraction are acute and subchronic MRLs for naphthalene, an intermediate MRL for acenaphthene, and a chronic MRL for l-methyl naphthalene; these MRLs are listed in Table 6-6. Although more health effects data are available for oral exposure than for inhalation exposure to the constituents of this fraction, selection of surrogate values to use for oral exposure to this fraction is problematic. The acute and intermediate MRLs for naphthalene, 0.05 and 0.02 mg/kg/day, are equivalent to or lower than any other MRLs for this fraction, including the chronic MRL for l-methyl naphthalene. The compounds in this fraction tend to cause hepatic and renal effects. Naphthalene and l-methyl naphthalene have respiratory effects following oral exposure; it is expected that

Table 6-5. Inhalation MRLs, Critical Effects, and EPA Cancer Assessments for Aromatic $EC_{>9}$–EC_{16} Fraction

C	EC	Compound or mixture	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per ppm[a]
				ppm	Effect	ppm	Effect[a]	ppm	Effect	
$EC_{>9}$-EC_{10}										
9	9.13	Isopropylbenzene (cumene)	–	–	–	–	[Renal and endocrine][b]	–	–	D, NA[b]
9 (8-10)	9.47–9.84 (8.81–0.52)	C_9 Aromatics: High flash aromatic naphtha[c]	–	–	–	–	–	–	[Hepatic and renal][c]	–
$EC_{>10}$-EC_{12}										
10	11.69	Naphthalene	1995e	–	–	–	–	0.002	Respiratory	D, NA[d]
$EC_{>12}$-EC_{16}										
12	15.06	Acenaphthylene	1995f	–	–	–	–	–	–	D, NA

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purpose of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] EPA (1998b) concluded that the listed effect, which occurred in a 13-week inhalation study in rats (Cushman et al. 1995), was the critical effect.

[c] A mixture composed primarily of C_9 alkylbenzenes, with approximately 80% in the EC_9–EC_{10} range and the entire mixture (identified constituents) within the ranges shown in parentheses in the table. The major constituents of the mixture are trimethylbenzenes and methylethylbenzenes. According to the TPHCWG (1997b) the listed critical effect was seen in a 1-year inhalation study in rats (Clark et al. 1989).

[d] EPA Classification in Group D occurred prior to publication of a chronic inhalation study of naphthalene in mice (NTP 1992). A 1995 note added to the carcinogenicity file on IRIS indicates naphthalene may be more appropriately classified in Group C (EPA 1998b).

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

Table 6-6. Oral MRLs, Critical Effects, and EPA Cancer Assessments for Aromatic $EC_{>9}$–EC_{16} Fraction

C	EC	Compound	ATSDR Tox. Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per mg/kg/day[a]
				mg/kg/day	Effect	mg/kg/day	Effect[a]	mg/kg/day	Effect[a]	
$EC_{>9}$-EC_{10}										
9	9.13	Isopropylbenzene (cumene)	–	–	–	–	[Renal][b]	–	–	D, NA
9	9.62	1,3,5-Trimethyl-benzene	–	–	–	–	[Hepatic, renal, other][c]	–	–	–
$EC_{>10}$-EC_{12}										
10	11.69	Naphthalene	1995e	0.05	Neurological	0.02	Hepatic	–	–	D, NA[d]
10-11	11.69-12.99	Naphthalene/ methylnaphtha-lene mixture[e]	–	–	–	–	[Hepatic, endocrine, other][e]	–	–	–
$EC_{>12}$-EC_{16}										
11	12.99	1-Methyl-naphthalene	1995e	–	–	–	–	0.07	Respiratory	–
12	14.26	Biphenyl	–	–	–	–	–	–	[Renal][f]	D, NA
12	15.06	Acenaphthylene	1995f	–	–	–	–	–	–	D, NA
12	15.5	Acenaphthene	1995f	–	–	0.6	Hepatic	–	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purpose of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] EPA (1997a, 1998b) concluded that the listed effect, which occurred in a 194-day oral study of isopropylbenzene in rats, was the critical effect.

[c] EPA (1996b) concluded that the listed effect, seen in a 90-day oral study in rats, was the critical effect.

[d] EPA Classification in Group D occurred prior to publication of chronic inhalation study of naphthalene in mice (NTP 1992). A 1995 note added to the carcinogenicity file on IRIS indicates naphthalene may be more appropriately classified in Group C (EPA 1998b).

[e] The TPHCWG (1997b) concluded that the listed effect, observed in an unpublished 13-week oral study of a mixture of naphthalene and methylnaphthalenes, was the critical effect. The composition of the mixture was not further specified. The above C and EC values assume the mixture contained naphthalene and *mono*methylnaphthalenes).

[f] According to EPA (1998b), the listed effect, seen in a lifetime oral study of 1,1,-biphenyl in rats, was the critical effect.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

2-methyl naphthalene will as well. Neurological effects have been seen from acute exposure to naphthalene, and would also be expected with the alkyl benzenes, based on the inhalation data. Thus, there is some commonality in the health effects. Naphthalene appears to be one of the more toxic constituents of this fraction, so adoption of the MRLs for naphthalene as surrogate values for the entire mass of this fraction should be relatively protective. There is no chronic MRL for naphthalene, however, and the chronic MRL for l-methyl naphthalene (0.07 mg/kg/day) is similar to, but slightly higher than the intermediate MRL for naphthalene.

Aromatic $EC_{>16}$- EC_{35} Combined Fraction. The combined fraction consists of the following two fractions:

$EC_{>16}$- EC_{21}: anthracene, fluorene, phenanthrene, pyrene and other less well-known PAHs

$EC_{>21}$- EC_{35}: benz(a)anthracene; benzo(b)-, benzoCj)- and benzo(k)fluoranthene; benzo(g,h,i)perylene; benzo(a)- and benzo(e)pyrene; chrysene; dibenz(a,h)anthracene; fluoranthene; and indeno(1,2,3-c,d)pyrene, and other less well-known PAHs.

Inhalation Exposure. Very few health effects data for inhalation exposure and no inhalation MRLs are available for this fraction. Given the nonvolatile nature of these compounds, inhalation exposure as a result of contamination at hazardous waste sites would be anticipated to occur only through exposure to dust or particles containing PAHs.

Oral Exposure. The limited oral data for these PAHs indicate that hepatic effects are a common sensitive effect; renal effects have been seen with some. Intermediate MRLs of 0.4 mg/kg/day have been derived for fluorene and fluoranthene and of 10 mg/kg/day for anthracene; these are listed in Table 6-7. All of the commonly studied PAHs in the $EC_{>16}$-EC_{21} portion of the combined fraction have been classified in Group D (not classifiable as to human carcinogenicity). Many of the commonly studied PAHs in the $EC_{>21}$-EC_{35} portion of the combined fraction have been classified in Group B2 (probable human carcinogen). An intermediate MRL of 0.4 mg/kg/day was selected as a surrogate value for the combined fraction and should be applied to the non-carcinogenic PAHs in this fraction. A method for assessing the potential carcinogenic effects of these PAHs would be to use the EPA cancer risk levels for benzo(a)pyrene and the relative potency factors for the individual PAHs (Table 6-7).

Table 6-7. Oral MRLs, Critical Effects, and EPA Cancer Assessments for Aromatic $EC_{>16}$–EC_{35} Fraction[a]

C	EC	Compound	Acute		Intermediate		Chronic		
			MRL		MRL		MRL		EPA Cancer WOE, risk per mg/kg/day[b]
			mg/kg/day	Effect	mg/kg/day	Effect[b]	mg/kg/day	Effect	
$EC_{>16}$-EC_{21}									
13	17	Fluorene	–	–	0.4	Hepatic	–	–	D, NA
14	19	Phenanthrene	–	–	–	–	–	–	D, NA
14	19	Anthracene	–	–	10	Hepatic	–	–	D, NA
16	21	Pyrene	–	–		[Renal][c]	–	–	D, NA
$EC_{>21}$-EC_{35}									
16	22	Fluoranthene	–	–	0.4	Hepatic	–	–	D, NA
18	26	Benz[a]anthracene	–	–	–	–	–	–	B2, RP=0.145
18	27	Chrysene	–	–	–	–	–	–	B2, RP=0.0044
20	30	Benzo[b]fluoranthene	–	–	–	–	–	–	B2, RP=0.167
20	30	Benzo[k]fluoranthene	–	–	–	–	–	–	B2, RP=0.020
20	31	Benzo[a]pyrene	–	–	–	–	–	–	B2, 7.3[d]; RP=1
22	34	Dibenz[a,h]anthracene	–	–	–	–	–	–	B2, RP=1.11
22	34	Benzo[g,h,i]perylene	–	–	–	–	–	–	D, NA
22	35	Indeno[1,2,3-cd]pyrene	–	–	–	–	–	–	B2, RP=0.055

[a] All the compounds in this table are PAHs, and are included in the ATSDR toxicological profile on PAHs (ATSDR 1995f).

[b] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures, compounds, or studies that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purposes of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[c] EPA (1997a, 1998b) concluded that the listed effect was the critical effect of pyrene, based on an unpublished oral 13-week study in mice (EPA 1995f). Although pyrene is included in the ATSDR toxicological profile on PAHs, this study was not cited (ATSDR 1995f). Therefore, it appears the study was not available to ATSDR for evaluation as a potential basis for an MRL.

[d] Dose levels associated with excess cancer risks of 10^{-4}, 10^{-5}, 10^{-6}, and 10^{-7} have been calculated to be $1x10^{-5}$, $1x10^{-6}$, $1x10^{-7}$, and $1x10^{-8}$ mg/kg/day, respectively.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; RP = Relative potency factor = the carcinogenic potency of this compound, relative to benzo[a]pyrene, as estimated by EPA (1993c) and reported by ATSDR (1995f). EPA (1993c) also reported relative potencies rounded to an order of magnitude and recommended that these rounded potencies be used because the quality of the data and the analysis do not support greater precision; WOE = weight-of-evidence classification for carcinogenicity

Aliphatic EC_5-EC_8 Combined Fraction. The combined fraction consists of the following two fractions:

EC_5- EC_6: *n*-pentane, *n*-hexane, dimethylbutanes, and methylpentanes, cyclopentane, some alkenes

$EC_{>6}$- EC_8: *n*-heptane, *n*-octane, some branched chain C_6-C_9 alkanes including trimethylpentanes, cyclohexane, methylcyclohexane, other cycloalkanes, some alkenes.

Inhalation Exposure. Only one inhalation MRL, a chronic MRL for *n*-hexane, is available for this combined fraction; this is listed in Table 6-8. *n*-Hexane produces a characteristic peripheral nephropathy in humans and animals; the chronic MRL is based on this effect in humans. Commercial hexane, which contains *n*-hexane plus other C_6 branched chain and cyclic alkanes (see Table 6-8), also has been shown to cause this effect in animals, due to its content of *n*-hexane (IRDC 1981) (see Section 6.2.4.1). The non *n*-hexane portion of the mixture does not. In addition, the non *n*-hexane constituents of this combined fraction do not appear to cause peripheral neuropathy when tested singly although, like *n*-hexane, they do cause neurological effects (depression of the central nervous system). *n*-Hexane and commercial hexane are respiratory irritants. Commercial hexane has undergone extensive recent testing as part of an EPA Test Rule under TSCA Section 4. However, until the database for commercial hexane can be more fully evaluated, the chronic MRL for *n*-hexane has been determined to be the most appropriate surrogate for a health guidance value for this fraction.

Oral Exposure. Health effects data regarding oral exposure to this fraction are limited and available mainly for *n*-hexane. *n*-Hexane caused peripheral neuropathy in two species of animals, indicating that effects by the oral route may be similar to those by the inhalation route. ATSDR concluded that the incompleteness of the oral database precluded derivation of oral MRLs for this compound.

Aliphatic $EC_{>8}$-EC_{16} Combined Fraction. The combined fraction consists of the following three fractions:

$EC_{>8}$- EC_{10}: *n*-nonane, *n*-decane, branched chain C_9C_{10} alkanes, substituted cycloalkanes, a few alkenes

Table 6-8. Inhalation MRLs, Critical Effects, and EPA Cancer Assessments for Aliphatic EC_5–EC_8 Fraction

C	EC	Compound	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per ppm[a]
				ppm	Effect	ppm	Effect	ppm	Effect[a]	
EC_5-EC_6										
6	6	*n*-Hexane	1999b	–	–	–	–	0.6	Neurological	D, NA[b]
6	5.68–6.59	Commercial hexane[c]	(1999b)[c]	–	–	–	–	–	[Respiratory, reproductive?][c]	–[d]
$EC_{>6}$-EC_8										
7	7	n-heptane	–	–	–	–	–	–	–	D, NA
7	7.22	Methylcyclohexane	–	–	–	–	–	–	[Renal?][e]	D, NA[e]
8	6.89	2,2,4-Trimethyl-pentane	–	–	–	–	–	NV	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b), unless otherwise specified. Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purposes of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] The WOE was determined by EPA (1989a).

[c] A mixture of C_6 alkanes, including ≈50% *n*-hexane. ATSDR (1999b) presented some toxicological data on commercial hexane, but did not consider the derivation of MRLs for this mixture. The TPHCWG (1997b) concluded that the above-listed effects were the critical effects, based on abstracts of unpublished 2-year inhalation studies of commercial hexane in rats and mice (Daughtrey et al 1994; Kelly et al 1994), which were not cited by ATSDR (1999b). The commercial hexane contained 53% n-hexane, 16% 3-methylpentane, 14% methylcyclopentane, 12% 2-methylpentane, 3 % cyclohexane, 1% 2,3-dimethylbutane, and <1% other constituents. The NOAELs chosen by the TPHCWG as the basis for the RfCs appear to be higher than the LOAELs for maternal toxicity in mice and rats in inhalation developmental toxicity studies (Bushy Run 1989a, 1989b). In addition, unpublished 26-week inhalation studies of a mixture of C_6 hexanes of approximately the same composition reported histopathologic evidence of peripheral neuropathy at a duration-adjusted LOAEL lower than the LOAELs in the 2-year studies (IRDC 1981). Thus, the conclusions of the TPHCWG regarding the critical effect need additional evaluation.

[d] Abstracts of unpublished chronic inhalation carcinogenicity studies of commercial hexane in rats and mice report evidence of carcinogenicity in female mice (Daughtrey et al. 1994; Kelly et al. 1994).

[e] Although EPA (1989c, 1997a) concluded that the critical effect of inhalation exposure methylcyclohexane was renal effects in male rats in a 1-year inhalation study with a postexposure observation period (Kinkead et al 1985), the effects appear to have been associated with $\alpha_{2\mu}$-globulin nephropathy, and thus may not be relevant to human health. The WOE was determined by EPA (1989c).

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; NV = not verifiable; the health effects data for this compound were reviewed by the EPA RfD/RfC Work Group and determined to be inadequate for the derivation of an RfC (EPA 1998b); WOE = weight-of-evidence classification for carcinogenicity

$EC_{>10}$- EC_{12} and $EC_{>12}$- EC_{16}: longer chain *n*-alkanes; probably larger branched and cyclic alkanes, but EC values not provided (TPHCWG 1997a).

Inhalation Exposure. Health effects data are available for inhalation exposure to some petroleum products corresponding to this combined fraction. Intermediate MRLs of 3 mg/m^3 for JP-5 and JP-8 and 0.01 mg/m^3 for kerosene, and a chronic MRL of 0.3 mg/m^3 for JP-7 have been derived; these are listed in Table 6-9. These four fuels are similar in composition, consisting primarily of aliphatics in the C_9-C_{16} range. All contain some significant aromatic components. In addition, health effects data from studies of two dearomatized petroleum streams have been evaluated by the TPHCWG (1997c). The sensitive effect for exposure to all these products is hepatic. The effect for kerosene, however, was a decrease in blood glucose levels, attributed to hepatic effects. The MRL for kerosene, based on this effect, appears to involve greater uncertainty as to the toxicological significance of the effect. As a result, the intermediate MRL of 3 mg/m^3 and chronic MRL of 0.3 mg/m^3 for the jet fuels have been determined to be the most appropriate surrogate values for the assessment of health effects due to exposure to this fraction.

Oral Exposure. Limited data are available for health effects of oral exposure to this combined fraction. Three studies of dearomatized petroleum streams have been evaluated by the TPHCWG (1997c) for use in RfD derivations, but these studies are unpublished and unreferenced. In addition, a study of JP-8 (Mattie et al. 1995) was used for RfD derivation by the TPHCWG (1997c). The critical effects are listed in Table 6-10. There are no MRLs relevant to this fraction. The sensitive effect of the dearomatized streams was hepatic. Some slight indications of hepatic effects were also seen in the study of JP-8, but no histopathological effects or changes in absolute organ weight.

Aliphatic $EC_{>16}$- EC_{35} Combined Fraction. The combined fraction consists of the following fractions:

$EC_{>16}$- EC_{21}: *n*-hepta-, *n*-octa-, and *n*-nonadecane, *n*-eicosadecane, and probably branched and cyclic alkanes

$EC_{>21}$- EC_{35}: longer chain *n*-alkanes and probably branched and cyclic alkane

Table 6-9. Inhalation MRLs, Critical Effects, and EPA Cancer Assessments for Aliphatic $EC_{>8}$–EC_{16} Fraction

C	EC	Compound or Mixture	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per mg/m^{3a}
				mg/m^3	Effect	mg/m^3	Effect[a]	mg/m^3	Effect	
10–11	–	C_{10}–C_{11} Iso-paraffinic solvent[b]	–	–	–	–	[Hepatic, adaptive][b]	–	–	–
7–11	–	Dearomatized white spirit[c]	–	–	–	–	[Hepatic, adaptive][c]	–	–	–
≈9–16	–	JP-7	1995c	–	–	–	–	0.3	Hepatic	–
9–16	–	JP-5, JP-8[d]	1998b	–	–	3[d]	Hepatic	–	–	–
9–16	–	Kerosene	1995g	–	–	0.01	Metabolic (hepatic)	–	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purposes of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] A mixture composed of C_{10}–C_{11} branched-chain alkanes. According to the TPHCWG (1997b), the listed effect, seen in a 12-week inhalation study in rats (Phillips and Eagan 1984), was adaptive rather than adverse.

[c] A mixture composed of C_7–C_{11} branched, straight, and cyclic alkanes. According to the TPHCWG (1997b), the listed effect, seen in a 12-week inhalation study in rats (Phillips and Eagan 1984), was adaptive rather than adverse.

[d] The intermediate inhalation MRL was derived for JP-5 and JP-8 based on a study of JP-5.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

Table 6-10. Oral MRLs, Critical Effects, and EPA Cancer Assessments for Aliphatic $EC_{>8}$–EC_{16} Fraction

C	EC	Compound or mixture	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per mg/kg/day[a]
				mg/kg/day	Effect	mg/kg/day	Effect[a]	mg/kg/day	Effect	
9–12	–	C_9–C_{12} Dearomatized aliphatic[b]	–	–	–	–	[Hepatic][b]	–	–	–
10–13	–	C_{10}–C_{13} Dearomatized aliphatic[c]	–	–	–	–	[Hepatic][c]	–	–	–
11–17	–	C_{11}–C_{17} Isoparaffinic solvent[d]	–	–	–	–	[Hepatic][d]	–	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purposes of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] A mixture composed of C_9–C_{12} branched, straight, and cyclic alkanes. The TPHCWG (1997c) concluded that the listed effect, which occurred in an unpublished and unreferenced 90-day oral study of this mixture in rats, was the critical effect.

[c] A mixture composed of C_{10}–C_{13} branched, cyclic, and straight alkanes. The TPHCWG (1997b) concluded that the listed effect, which occurred in an unpublished and unreferenced 13-week oral study of this mixture in rats, was the critical effect.

[d] A mixture composed of C_{11}–C_{17} branched and cyclic alkanes. The TPHCWG (1997b) concluded that the listed effect, seen in an unpublished and unreferenced 90-day oral study of this mixture in rats, was the critical effect.

C = carbon number; EC = Equivalent Carbon Number Index; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity

Inhalation Exposure. No information was located on the health effects of inhalation exposure to compounds or mixtures of petroleum hydrocarbons that fall within this fraction.

Oral Exposure. No pertinent assessments by ATSDR exist, but studies of mixtures of mineral oil hydrocarbons have been evaluated by the TPHCWG (for use in deriving RfDs for this fraction). Table 6-l 1 summarizes the pertinent information. The critical effect of these mineral oils was judged to be hepatic.

6.7 RELEVANCE TO PUBLIC HEALTH

This profile covers total petroleum hydrocarbons (TPH), which is defined as the measurable amount of petroleum-based hydrocarbon in an environmental medium (Chapter 2). TPH is measured as the total quantity of hydrocarbons without identification of individual constituents. Sources of TPH contamination in the environment range from crude oil, to fuels such as gasoline and kerosene, to solvents, to mineral- based crankcase oil and mineral-based hydraulic fluids. These products contain not only a large number and variety of petroleum hydrocarbons, but also other chemicals that, strictly speaking, are not the subject of this profile, such as non-hydrocarbon additives and contaminants. The TPH issue is further complicated by the number of petroleum-derived hydrocarbons that have been identified-more than 250-and the variability in composition of crude oils and petroleum products (see Section 3.2 and Appendices D and E for details).

Following a spill, leak, or other release of a petroleum product into the environment, changes occur in the location and composition of the released hydrocarbons, as described in Section 5.3. The smaller molecular weight hydrocarbons, which tend to have relatively high vapor pressures and/or water solubilities, tend to volatilize into the air, dissolve into infiltrating rainwater or groundwater and migrate away from the release area, and biodegrade. The larger molecular weight constituents tend to sorb to soil or sediment and remain relatively immobile.

Because TPH is a complex and highly variable mixture, assessment of health impacts depends on several factors, assumptions, and circumstances. Of prime importance is the specific exposure scenario. For example, immediately following a large release of a “lighter” petroleum product (e.g., automotive gasoline), central nervous system depression could occur in people in the immediate vicinity of the spill if

Table 6-11. Oral MRLs, Critical Effects, and EPA Cancer Assessments for Aliphatic $EC_{>16}$–EC_{35} Fraction

C	EC	Compound	ATSDR Toxicological Profile	Acute		Intermediate		Chronic		
				MRL		MRL		MRL		EPA Cancer WOE, risk per mg/kg/day[a]
				mg/kg/day	Effect	mg/kg/day	Effect[a]	mg/kg/day	Effect	
15–37	–	Low MW Mineral oils[b]	–	–	–	–	[Hepatic][b]	–	–	–
27–45	–	High MW Mineral oils[c]	–	–	–	–	[Hepatic][c]	–	–	–

[a] EPA cancer WOE and risk are from the cited ATSDR toxicological profile and/or IRIS (EPA 1998b). Critical effects are listed in brackets for mixtures or compounds that are not the subjects of ATSDR toxicological profiles, but have been evaluated by other agencies for the purposes of deriving health effects criteria. These health effects are shown only to indicate potentially sensitive endpoints of exposure to that fraction, and do not have the same level of confidence as an ATSDR assessment.

[b] Five mixtures of cyclic alkanes with the following carbon ranges (15–30, 17–30, 21–35, and 22–37) and one mixture of branched chain alkanes of carbon range 18–30 were tested in a 90-day oral study in rats (Smith et al. 1996). The TPHCWG (1997b) concluded that the listed effect was the critical effect. The conclusion that one of the observed effects (mesenteric lymph node histiocytosis) was not adverse may need further evaluation, as does the existence of a LOAEL for one of these mixtures (Firriolo et al 1995) at a dose slightly lower than the NOAEL in the selected study.

[c] Two mixtures of branched-chain alkanes with carbon ranges of 27–43 and 28–45 were tested in a 90-day oral study in rats (Smith et al. 1996). The TPHCWG (1997b) concluded that the listed effect was the critical effect. The conclusion that one of the observed effects (mesenteric lymph node histiocytosis) was not adverse may need further evaluation.

C = carbon number; EC = Equivalent Carbon Number Index; MW = Molecular weight; MRL = minimal risk level; NA = not applicable; WOE = weight-of-evidence classification for carcinogenicity they inhaled the volatilized components. In a confined or poorly ventilated area, asphyxiation would even be a concern. Contamination of groundwater and surface water with the soluble components (e.g., the BTEXs) could impact drinking water sources. Exposure to a contaminated water supply may take place over a period of weeks or years, and raises concerns for more subtle nervous system effects, developmental effects, and cancer. The less volatile or soluble constituents (such as benzo(a)pyrene) may tend to remain in the area of the release for extended periods. Even during the early stages of this release scenario, exposures will tend to be to fractions of the product (the more volatile or more soluble compounds) rather than to the whole product. Therefore, public health assessments for TPH require knowledge of the specific fractions and/or chemicals at the point of exposure (e.g., drinking water well, soil, air). These data are summarized in this toxicological profile (particularly Sections 3.2 and 6.3) and provided in more detail in the toxicological profiles on the individual components and whole products.

A central tool in ATSDR assessment of public health impacts is the minimal risk level (MRL) health guidance value. MRLs have been developed by ATSDR for many hazardous waste constituents, though no new MRLs have been developed for TPH. A limited number of existing MRLs can be applied to TPH assessment. Most are MRLs for individual TPH components (e.g., benzene); however, a few MRLs are available for whole petroleum products. MRLs for substances that represent the fractions defined by the ATSDR approach to assessing TPH health impacts are provided and discussed in this profile. In recognition of the likelihood that even acute exposures to fresh releases will be to fractions of a product, the information on pertinent fractions of TPH should also be consulted (particularly Sections 2.3, 6.1, 6.2 and 6.6).

In the case of weathered releases, the fraction approach is likely to be the most useful. Analytical methods that support the fraction approach should be chosen to characterize exposures (Section 3.3, TPHCWG approach). The identity of the original contaminating product(s) need not be known. Health effects data for these fractions are discussed in Section 6.2 and recommendations for fraction-specific MRLs and for cancer assessment are presented in Section 6.6.

The issue of exposure to complex mixtures was introduced and briefly discussed in Section 6.1.1. In Sections 6.1.2 and 6.1.3 other related TPH approaches are discussed. The ATSDR fraction approach preferentially adopts MRLs for petroleum products that are similar in composition to the transport fraction. When no such data are available, a surrogate MRL from a representative constituent of the fraction is adopted for the entire mass of the fraction, a practice which implicitly assumes that the toxicity of the constituents of a fraction is additive. This approach is consistent with existing ATSDR and EPA guidance (ATSDR 1992; De Rosa et al. 1996; EPA 1986; Johnson and De Rosa 1995; Mumtaz et al. 1994).

Additional refinements to the fraction approach for assessing health effects include estimation of an index of concern (IOC) for the indicator compounds (the BTEXs) of the aromatic EC_5-EC_9 fraction, or to account for exposure to more than one fraction. This approach is also based on the assumption of additivity, and is reasonable for compounds or fractions that affect the same system or target organ. The IOC is the sum of the ratios of the monitored level of exposure to the accepted level of exposure for each of the constituents of a mixture:

$$IOC = E_{1},/AL_{1} + E_{2}AL_{2\ldots} + E_{i}/AL_{i}$$

where:

E_I = the actual exposure level to the ith component
$AL,$ = the acceptable exposure level for the ith component

The accepted levels of exposure for ATSDR assessments would be inhalation MRLs, or soil or water concentrations calculated from oral MRLs. For example, the IOC method could be applied to acute oral exposures to the aromatic EC_5-EC_9 fraction (toluene, *p*-xylene) and the aromatic $EC_{>9}$-EC_{16} fraction, for which the critical effects are neurological (Table 6-2).

Other refinements could be provided by implementing the target-organ toxicity dose approach, which attempts to estimate the plausible critical effect and IOC that would have been calculated had the particular mixture been tested (Mumtaz et al. 1994, 1997). This approach is complicated, and would be suggested only when additional assessment is needed, perhaps to resolve differences between expected and actual health effects outcomes, or where critical effects are different across constituents or fractions that make up the "mixture."

Another complicated mixtures assessment method under investigation by ATSDR is the weight-of- evidence method for interactions (De Rosa et al. 1996; Johnson and De Rosa 1995; Mumtaz et al. 1994;

Mumtaz and Durkin 1992). This method provides adjustments to the IOC to take into account interactions between the constituents of the mixture. Application to the BTEXs, particularly benzene and toluene, for which interactions have been reasonably well characterized, may be fruitful if needed to resolve issues in a health assessment.

Regardless of the circumstances and methods, TPH health assessments are limited by data gaps in the toxicology for many of the compounds, transport fractions, and mixtures of petroleum products and wastes. The limitations of the analytical method(s) used to generate the TPH data must be understood (e.g., whether the analytical method identified transport fractions or specific compounds) (see Section 3.3). As long as the uncertainties and data limitations are recognized, the method described in Section 6.1.3 and the health effects information in Sections 6.2 and 6.3 provide general guidance for health assessments for TPH.

6.8 BIOMARKERS OF EXPOSURE AND EFFECT

Biomarkers are broadly defined as indicators signaling events in biologic systems or samples. They have been classified as markers of exposure, markers of effect, and markers of susceptibility (NAS/NRC 1989).

Due to a nascent understanding of the use and interpretation of biomarkers, implementation of biomarkers as tools of exposure in the general population is very limited. A biomarker of exposure is a xenobiotic substance or its metabolite(s), or the product of an interaction between a xenobiotic agent and some target molecule(s) or cell(s) that is measured within a compartment of an organism (NAS/NRC 1989). The preferred biomarkers of exposure are generally the substance itself or substance-specific metabolites in readily obtainable body fluid(s) or excreta. However, several factors can confound the use and interpretation of biomarkers of exposure. The body burden of a substance may be the result of exposures from more than one source. The substance being measured may be a metabolite of another xenobiotic substance (e.g., high urinary levels of phenol can result from exposure to several different aromatic compounds). Depending on the properties of the substance (e.g., biologic half-life) and environmental conditions (e.g., duration and route of exposure), the substance and all of its metabolites may have left the body by the time samples can be taken. It may be difficult to identify individuals exposed to hazardous substances that are commonly found in body tissues and fluids (e.g., essential mineral nutrients such as copper, zinc, and selenium). Biomarkers of exposure to total petroleum hydrocarbons are discussed in Section 6.8.1.

Biomarkers of effect are defined as any measurable biochemical, physiologic, or other alteration within an organism that, depending on magnitude, can be recognized as an established or potential health impairment or disease (NAS/NRC 1989). This definition encompasses biochemical or cellular signals of tissue dysfunction (e.g., increased liver enzyme activity or pathologic changes in female genital epithelial cells), as well as physiologic signs of dysfunction such as increased blood pressure or decreased lung capacity. Note that these markers are not often substance specific. They also may not be directly adverse, but can indicate potential health impairment (e.g., DNA adducts). Biomarkers of effects caused by total petroleum hydrocarbons are discussed in Section 6.8.2.

A biomarker of susceptibility is an indicator of an inherent or acquired limitation of an organism's ability to respond to the challenge of exposure to a specific xenobiotic substance. It can be an intrinsic genetic or other characteristic or a preexisting disease that results in an increase in absorbed dose, a decrease in the biologically effective dose, or a target tissue response. Biomarkers of susceptibility are discussed in Section 6.10, Populations That Are Unusually Susceptible.

More information on biomarkers of exposure and effect to specific petroleum hydrocarbons can be found in ATSDR toxicological profiles on benzene (ATSDR 1997a), toluene (ATSDR 1994), ethylbenzene (ATSDR 1999a), xylenes (ATSDR 1995d), hexane (ATSDR 1999b), naphthalene (ATSDR 1995e) and polycyclic aromatic hydrocarbons (ATSDR 1995f); information for specific petroleum products can be found in ATSDR profiles on automotive gasoline (ATSDR 1995a), fuel oils (ATSDR 1995g), jet fuels (ATSDR 1995c 1998b), mineral-based crankcase oils (ATSDR 1997c), hydraulic fluids (ATSDR 1997b), and Stoddard solvent (ATSDR 1995b).

6.8.1. Biomarkers Used to Identify or Quantify Exposure to TPH

Because of the compositional complexity of TPH, detection of specific hydrocarbons or their metabolites in biological fluids or tissues cannot be expected to provide a reliable biomarker of exposure to petroleum-derived hydrocarbons in general. However, detection of specific hydrocarbons (or their metabolites) from several aromatic and/or aliphatic fractions in biological fluids or tissues can provide reliable evidence of exposure. Examples of proposed biomarkers of exposure to petroleum products include: benzene in exhaled air and phenol in urine to indicate exposure to gasoline (IARC 1989a), the odor of kerosene on the breath or clothing to indicate oral or dermal exposure to kerosene, and radiological findings of lung infiltrations to indicate oral or inhalation exposure to kerosene or other petroleum products (ATSDR 199.58; Snodgrass 1997). Lipid granulomatas found in autopsied livers and spleens (i.e., lipoid droplets surrounded by lymphocytes and macrophages) are thought to be caused by dietary exposure to mineral oils and waxes (Wanless and Geddie 1985; Miller et al. 1996); their detection in autopsied tissues may be useful as an index of exposure to petroleum hydrocarbons, especially hydrocarbons in the aliphatic $EC_{>16}$-EC_{35} fractions.

6.8.2 Biomarkers Used to Characterize Effects Caused by TPH

Symptoms of neurological dysfunction, such as ataxia, poor coordination and gait irregularities, are potential biomarkers of effect from acute or repeated high-level exposure to petroleum-derived hydrocarbons in the aliphatic EC_5-EC_8 and aromatic EC_5-EC_9 fractions (see ATSDR 1994, 1995a, 1995c, 1995d, 1995f, 1997a, 1998b, 1999a, 1999b). Such symptoms, while shared by many hydrocarbons in these fractions, are not specific to petroleum hydrocarbons and could indicate exposure to other substances such as halogenated hydrocarbons or neurotoxic metals. Such symptoms, however, are not expected from the low-level exposure to hydrocarbons in these fractions that is likely to be experienced by people residing in the vicinity of disposal sites contaminated with petroleum hydrocarbons.

Measurements of motor and sensory nerve conduction velocities and action potential amplitudes have been proposed as sensitive preclinical biomarkers of peripheral neuropathy in workers repeatedly exposed to *n*-hexane (ATSDR 1999b), but this effect is specific to *n*-hexane (and perhaps a few other aliphatic hydrocarbons in the EC_5-EC_8 fraction) among petroleum hydrocarbons.

Many, but not all, PAHs (aromatic $EC_{>16}$-EC_{35} hydrocarbons) are genotoxic in various test systems and carcinogenic in animal test systems. The measurement of benzo(a)pyrene-DNA adducts in human body tissues or fluids has been proposed as a biomarker of effect from exposure to combustion or pyrolytic products containing genotoxic and carcinogenic PAHs, of which benzo(a)pyrene is the most extensively studied (see ATSDR 1995f). These measurements, however, are specific to benzo(a)pyrene and do not identify the source of the benzo(a)pyrene (PAHs are ubiquitous in the environment because they are produced by the pyrolysis or combustion of any material containing hydrocarbons).

Hematological effects from exposure to hydrocarbons in the aromatic EC_5-EC_9 and $EC_{>9}$-EC_{16} fractions include hemolytic anemia from naphthalene exposure and decreased hematopoiesis and leukemia from benzene exposure. Because these effects are not specific to these hydrocarbons, frequent monitoring of blood cell counts in benzene-exposed workers has been used as a biomarker of hematotoxic effects (see ATSDR 1997a).

6.9 INTERACTIONS WITH OTHER SUBSTANCES

Individuals exposed to TPH in the environment are exposed to complex mixtures that are not generally restricted to hydrocarbons alone. It is reasonable to expect that components of such complex mixtures may interact to produce additive effects that do not influence the toxicity of individual components, and synergistic or antagonistic effects that do. Studies with the BTEXs (see ATSDR 1994, 1995d, 1997a, 1999a), with naphthalene and methylnaphthalenes (see ATSDR 1995e), with PAHs (ATSDR 1995f), and with hexane (ATSDR 1999b) indicate that competitive or non-competitive inhibitory interactions with active sites of cytochrome P-450 isozymes, epoxide hydrolases, or other enzymes can influence metabolism of individual hydrocarbons. This can lead to antagonism of toxic effects mediated by metabolic intermediates (e.g., hematopoietic and cancer effects from benzene, cancer, or genotoxic effects from carcinogenic PAHs such as benzo(a)pyrene or dibenz(a,h)anthracene; peripheral neuropathy from hexane) or synergism or potentiation of toxic effects mediated by the parent hydrocarbon (e.g., acute CNS depression from the BTEXs). In addition, inductive or enhancing effects on enzyme activities can increase metabolic rate or capacity leading to potential non-additive interactive effects on hydrocarbon toxicities: potential synergism or potentiation toxic effects with induction of enzymes catalyzing the production of toxic intermediates, and potential antagonism of toxic effects with induction of detoxifying enzymes. Given the compositional complexity of TPH mixtures that may be found in the environment, it is difficult, if not impossible, to make reliable statements predicting the magnitude and direction of specific interactions that may occur. In the face of such large uncertainty, assuming that chemicals in complex mixtures interact in an additive manner at a particular target organ may be the most reasonable approach because it is the most simple.

6.10 POPULATIONS THAT ARE UNUSUALLY SUSCEPTIBLE

A susceptible population will exhibit a different or enhanced response to petroleum hydrocarbons than will most people exposed to the same level of petroleum hydrocarbons in the environment. Reasons may include genetic makeup, age, health and nutritional status, and exposure to other toxic substances (e.g., cigarette smoke). These parameters may result in reduced detoxification or excretion of petroleum hydrocarbons, or compromised function or organs affected by petroleum hydrocarbons.

Factors that inhibit or alter the activity of the mixed function oxidase enzymes may increase the risk from exposure to the indicator compounds in the aromatic EC_5-EC_9 fraction (the BTEXs), the aromatic $EC_{>16}$-EC_{35} fraction (the carcinogenic PAHs in this fraction) and a constituent of the aliphatic EC_5-EC_8 fraction (*n*-hexane). For example, concurrent alcohol consumption may increase the risk of central nervous system depression from the BTEXs, ototoxicity from toluene, and hematotoxicity from benzene. Acetone exposure may increase the risk of peripheral neuropathy of *n*-hexane. People who take haloperidol, acetaminophen, or aspirin, or who have a nutritionally inadequate diet, may also be more susceptible to the toxicity of these agents. ATSDR (1995f) noted that a substantial percentage of children consume less than the recommended dietary allowances of certain nutrients.

Other populations are unusually susceptible to the aromatic EC_5-EC_9 fraction. People with l3-thalassemia may be at risk for benzene exposure because some forms of β-thalassemia may exacerbate the adverse effects of benzene on the hematopoietic system. Children and fetuses may be at increased risk to benzene toxicity because their hematopoietic cell populations are expanding and dividing cells are at a greater risk than quiescent cells. Developmental effects in animals are the basis for intermediate inhalation MRLs for ethylbenzene and mixed xylene, indicating that the embryo/fetus may be particularly sensitive to these two BTEXs. People with subclinical and clinical epilepsy are considered at increased risk of seizures from xylene because of its central nervous system effects.

Person with inherited erythrocyte G6PD deficiency have an enhanced susceptibility to the hemolytic effects of naphthalene, a constituent of the aromatic $EC_{>9}$-EC_{16} fraction. Infants appear to be more sensitive than adults to this effect, and infants are more prone to permanent neurological damage as a consequence of the jaundice that results from the hemolysis. Naphthalene has been shown to cross the human placenta to cause hemolysis and hemolytic anemia in the newborn infants of mothers who consumed naphthalene during pregnancy (ATSDR 1995e).

People with aryl hydrocarbon hydroxylase (AHH) that is particularly susceptible to induction may be more susceptible to the carcinogenic PAHs found in the aromatic $EC_{>16}$-EC_{35} fraction. Individuals undergoing rapid weight loss that includes loss of body fat are anticipated to be at risk because of the systemic release and activation of PAHs that had been stored in fat. People with genetic diseases that are associated with DNA-repair deficiencies (e.g., xeroderma pigmentosum, ataxia telangiectasia, familial retinoblastoma, Down's syndrome) may be more susceptible to PAH-related malignancy. Individuals who have significant exposure to ultraviolet radiation, as from sunlight, may be at increased risk of developing skin cancer from PAH exposure. The human fetus may also be particularly susceptible to PAH toxicity because of increased permeability of the embryonic/fetal blood-brain barrier and a decreased liver-enzyme conjugating function. Based on studies of benzo(a)pyrene in animals, women may be at increased risk of reproductive dysfunction following exposure to high levels of PAHs.

Individuals with impaired pulmonary function may be more susceptible to the respiratory irritant effects of the volatile petroleum hydrocarbons (primarily the aromatic EC_5-EC_9 and aliphatic EC_5-EC_9 fractions).

Additional information regarding populations unusually susceptible to the aliphatic EC_5-EC_8, $EC_{>8}$-EC_{16}, and $EC_{>16}$-EC_{35}, fractions is limited. Factors that alter the function of mixed function oxidase enzymes may increase the risk of peripheral neuropathy from exposure to *n*-hexane, a constituent of the EC_5-EC_8 fraction. A single animal study indicates that susceptibility to the neuropathic effects of *n*-hexane was more severe in young adults than in weanlings. A single study of kerosene ($EC_{>8}$-EC_{16}) in rats showed that younger animals, and particularly preweanlings, were more susceptible than older rats to the lethality of kerosene, but whether these findings for *n*-hexane and kerosene can be extrapolated to humans is uncertain. Case reports of accidental poisoning through ingestion indicate that children 5 years old or younger often mistakenly drank kerosene because it was accessible. The applicability of this scenario to hazardous waste sites is questionable.

More detailed information regarding populations that are unusually susceptible to petroleum hydrocarbons can be obtained from the ATSDR toxicological profiles (ATSDR 1994, 1995d, 1995e, 1995f, 1997a, 1998b, 1999a, 1999b) on which this section was based. Other pertinent toxicological profiles (ATSDR 1995b, 1995c, 1995g) noted a lack of information on susceptible populations.

6.11 METHODS FOR REDUCING TOXIC EFFECTS

This section will describe clinical practice and research concerning methods for reducing toxic effects of exposure to petroleum hydrocarbons. However, because some of the treatments discussed may be experimental and unproven, this section should not be used as a guide for treatment of exposures to petroleum hydrocarbons. When specific exposures have occurred, poison control centers and medical toxicologists should be consulted for medical advice. The following texts provide specific information about treatment following exposures to petroleum hydrocarbons:

> Snodgrass, W.R. 1997. Clinical Toxicology. In: Cassarett and Doull's Toxicology. The Basic Science of Poisons. Fifth Edition. pp. 969-986. C.D. Klaassen, M.O. Amdur, and J. Doull, eds McGraw-Hill, New York.
>
> Friedman, P.A. 1987. Poisoning and Its Management. In: Harrison's Principles of Internal Medicine. Eleventh Edition. pp. 838-850. J.D. Jeffers, E.J. Scott and M. Ramos-Englis, eds. McGraw-Hill. New York.
>
> Klaasen, C.D. 1996. Nonmetallic Environmental Toxicants. Air Pollutants, Solvents and Vapors, and Pesticides. In: Goodman and Gilman's The Pharmacological Basis of Therapeutics. Ninth Edition. J.G. Hardman and L.E. Limbird, eds. McGraw-Hill, New York.

Information on methods that may be effective in reducing absorption, reducing body burdens, or interfering with mechanisms of toxic action of specific petroleum hydrocarbons can be found in ATSDR profiles on the BTEXs (ATSDR 1994, 1995d, 1997a, 1999a), hexane (ATSDR 1999b), naphthalene (ATSDR 1995f), and PAHs (1995f). Additional information for petroleum products can be found in ATSDR profiles on automotive gasoline (ATSDR 1995a), fuel oils (ATSDR 19958) jet fuels (ATSDR 199512, 1998b), mineral-based crankcase oils (ATSDR 1997c) hydraulic fluids (1997b), and Stoddard solvent (ATSDR 1995b).

6.11.1 Reducing Peak Absorption Following Exposure

It is commonly recognized that, in the treatment of poisoning from ingestion of low viscosity, aliphatic or aromatic hydrocarbons found in petroleum products such as gasoline and kerosene, care must be taken to prevent aspiration into the respiratory tract (Friedman 1987; Klaassen 1996; Snodgrass 1997). Emesis, gastric lavage, and treatment with activated charcoal are often avoided unless large amounts have been ingested (>l00 mL) or there is a known risk of absorption of non-hydrocarbon additives (e.g., metals, pesticides) that may produce systemic effects. If gastric lavage is applied, an endotracheal tube with inflatable cuff is often used to prevent aspiration. Viscous, large molecular weight aliphatic hydrocarbons such as those in mineral oil, heavy lubricants, and Vaseline are not aspirated to the lung and have cathartic properties; removal treatments are not usually used. Absorption of petroleum hydrocarbons by the skin following dermal exposure can be reduced by washing with a mild soap or detergent and water, taking care not to abrade the skin.

6.11.2 Reducing Body Burden

Petroleum-derived hydrocarbons and their metabolites (e.g., fatty acids), especially those in the aliphatic and aromatic $EC_{>16}$-EC_{35} fractions, tend to accumulate in the liver, spleen, and adipose tissues. There are no known clinical methods to facilitate or accelerate removal of petroleum hydrocarbons or their metabolites from these tissues.

6.11.3 Interfering with the Mechanism of Action for Toxic Effects

Acute inhalation or aspiration of ingested aliphatic or aromatic petroleum hydrocarbons of low viscosity can lead to pulmonary irritation and hydrocarbon pneumonia, an acute hemorrhagic necrotizing disease. To counteract secondary bacterial infections and pulmonary edema, antibiotics and oxygen therapy are often applied when indicated by symptoms in particular patients (Klaassen 1996; Snodgrass 1997).

Specific aliphatic and aromatic hydrocarbons found in petroleum products are known to be-metabolized via cytochrome P-450 pathways to reactive metabolic intermediates that are thought to cause non-cancer and cancer effects from chronic exposure (e.g., peripheral neuropathy from 2,5-hexadione, a metabolite of hexane, and cancer effects from various intermediary metabolites of benzene and carcinogenic PAHs). There are no known clinical methods to interfere with these mechanisms of action. However, current research programs are studying the basis of how the consumption of cruciferous vegetables may protect against chemical carcinogenesis, and examining the protective role that may be played by dietary antioxidants and the induction of Phase II enzymes (enzymes involved in the detoxification of products of cytochrome P-450 enzymes) (see Prochaska and Talalay 1992; Zhang et al. 1992; Talalay 1992; Fahey et al. 1997). Results from this type of research may lead to clinical methods counteracting the toxic effects of chronic exposure to bioactivated hydrocarbons.

6.12 ADEQUACY OF THE DATABASE

The adequacy of the database for many of the constituents of TPH and for petroleum products has been fully discussed in the corresponding toxicological profiles. This section will briefly discuss adequacy of the database to support a fraction-based assessment of TPH.

The database for the aromatic EC_5-EC_9 fraction is that for the individual BTEXs; the recommendation in this profile is to assess each of these compounds individually as indicator compounds. The database for inhalation exposure is more adequate than for oral exposure. Details are provided in the respective ATSDR profiles (ATSDR 1994, 1995d, 1997a, 1999a).

The database for the aromatic $EC_{>9}$-EC_{16} fraction lacks information on a mixture or mixtures that could represent the entire combined fraction. Limited inhalation data are available on a mixture of C9 aromatics (high flash aromatic naphtha, primarily $EC_{9.47}$-$EC_{9.84}$). Health effects data from these mixtures and from potential representative chemicals, including naphthalene, suggest some commonality of effect among constituents of this fraction. MRLs are available for chronic inhalation exposure and all three periods of oral exposure. Surrogate MRL values are suggested for chronic inhalation exposure and acute and intermediate oral exposure to this fraction. Nevertheless, the data do not *strongly* support a surrogate approach. Additional information on the database for naphthalene, 1- and 2-methyl naphthalene, acenaphthylene and acenaphthene is discussed in ATSDR (1995e, 1995f).

The adequacy of the database for the aromatic $EC_{>16}$-EC_{35} fraction, which consists of PAHs, is discussed in ATSDR (1995f). Data for suitable mixtures were not identified. Inhalation data for the individual constituents were particularly limited; no MRLs were available. The oral data support the selection of a surrogate MRL for intermediate exposure to the noncarcinogenic constituents of this fraction, but it is uncertain whether this value is appropriate to represent the noncancer effects of the carcinogenic PAHs.

The database for inhalation exposure to the aliphatic EC_5-EC_8 fraction includes data for a representative mixture, commercial hexane, but many of the studies were performed under a TSCA test rule and have been published only as abstracts (TPHCWG 1997c). ATSDR (1999b) briefly discussed commercial hexane in the toxicological profile on *n*-hexane, but did not consider MRL derivation for commercial hexane, as it was not the subject of the profile. The only compound or petroleum product corresponding to this fraction that has been the focus of MRL derivation by ATSDR is *n*-hexane, for which a chronic inhalation MRL is available. The data were considered inadequate for the derivation of oral MRLs for this compound (ATSDR 1999b). Details of the adequacy of the database for *n*-hexane are provided by ATSDR (1999b).

For the aliphatic $EC_{>8}$-EC_{16} fraction, the database includes a number of studies of petroleum products whose major constituents fall within the EC range of this fraction. These included dearomatized petroleum streams and fuels (JP-5, JP-7, JP-8, kerosene). Studies of the dearomatized petroleum streams are largely unpublished, include oral studies in animals, and have been reviewed by the TPHCWG (1997c). The critical effects were judged to be hepatic. MRLs were available for intermediate and chronic inhalation exposure to JP-7 and JP-5 and JP-8; these are based on hepatic effects. The MRLs for these jet fuels appeared suitable to represent the health effects of the fraction. Detailed analyses of the adequacy of the database for the fuels are provided by ATSDR (1995c, 1995g), 1998).

Mineral oils, which are petroleum products similar in composition to the aliphatic $EC_{>16}$-EC_{35} fraction, have been tested by the oral route, as reviewed by the TPHCWG (1997c); the TPHCWG based its derivation of health effects criteria on these studies. Issues regarding the TPHCWG’s derivation include the classification of histiocytosis as a nonadverse effect and the suitability of the F344 rat to serve as a model for humans for this class of compounds (Section 6.2.6.2). ATSDR has not considered the health effects of these products in a toxicological profile, and there are no other petroleum products or constituents corresponding to this fraction that have MRLs.

Ongoing studies of interest are the studies performed under a Section 4 TSCA test rule of commercial hexane and of cyclohexane mentioned by the TPHCWG (1997c). In addition, the Verhaar et al. (1997) describe a proposed approach and ongoing research to develop PBPK/PD models for use in assessing human health risks from exposure to JP-5.

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TRICHLOROETHYLENE

Chemical Identifiers | Hazards | Response Recommendations | Physical Properties | Regulatory Information | Alternate Chemical Names

Chemical Identifiers

What is this information? ▶

CAS Number	UN/NA Number	DOT Hazard Label	CHRIS Code
79-01-6	1710	Poison	TCL

NFPA 704

Diamond	Hazard	Value	Description
1 2 0	◆ Health	2	Can cause temporary incapacitation or residual injury.
	◆ Flammability	1	Must be preheated before ignition can occur.
	◆ Instability	0	Normally stable, even under fire conditions.
	◇ Special		

(NFPA, 2010)

General Description

A clear colorless volatile liquid having a chloroform-like odor. Denser than water and is slightly soluble in water. Noncombustible. Used as a solvent, fumigant, in the manufacture of other chemicals, and for many other uses.

Hazards

What is this information? ▶

Reactivity Alerts

none

Air & Water Reactions

Slightly soluble in water.

Fire Hazard

Special Hazards of Combustion Products: Toxic and irritating gases are produced in fire situations. (USCG, 1999)

Health Hazard

INHALATION: symptoms range from irritation of the nose and throat to nausea, an attitude of irresponsibility, blurred vision, and finally disturbance of central nervous system resulting in cardiac failure. Chronic exposure may cause organic injury. INGESTION: symptoms similar to inhalation. SKIN: defatting action can cause dermatitis. EYES: slightly irritating sensation and lachrymation. (USCG, 1999)

Reactivity Profile

It has been determined experimentally that mixtures of finely divided barium metal and a number of halogenated hydrocarbons possess an explosive capability. Specifically, impact sensitivity tests have shown that granular barium in contact with monofluorotrichloromethane, trichlorotrifluoroethane, carbon tetrachloride, trichloroethylene, or tetrachloroethylene can detonate (ASESB Pot. Incid. 39. 1968; Chem. Eng. News 46(9):38. 1968). It has been determined experimentally that a mixture of beryllium powder with carbon tetrachloride or with trichloroethylene will flash or spark on heavy impact (ASESB Pot. Incid. 39. 1968). A mixture of powdered magnesium with trichloroethylene or with carbon tetrachloride will flash or spark under heavy impact (ASESB Pot. Incid, 39. 1968).

Belongs to the Following Reactive Group(s)

- Halogenated Organic Compounds
- Hydrocarbons, Aliphatic Unsaturated

Potentially Incompatible Absorbents

Use caution: Liquids with this reactive group classification have been known to react with the absorbent listed below. More info about absorbents, including situations to watch out for...

- Dirt/Earth

Response Recommendations

What is this information? ▶

Isolation and Evacuation

Excerpt from GUIDE 160 [Halogenated Solvents]:

As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.

LARGE SPILL: Consider initial downwind evacuation for at least 100 meters (330 feet).

FIRE: If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions. (ERG, 2012)

Firefighting

Excerpt from GUIDE 160 [Halogenated Solvents]:

SMALL FIRE: Dry chemical, CO2 or water spray.

LARGE FIRE: Dry chemical, CO2, alcohol-resistant foam or water spray. Move containers from fire area if you can do it without risk. Dike fire-control water for later disposal; do not scatter the material.

FIRE INVOLVING TANKS OR CAR/TRAILER LOADS: Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Cool containers with flooding quantities of water until well after fire is out. Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank. ALWAYS stay away from tanks engulfed in fire. (ERG, 2012)

Non-Fire Response

Excerpt from GUIDE 160 [Halogenated Solvents]:

ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Stop leak if you can do it without risk.

SMALL LIQUID SPILL: Take up with sand, earth or other non-combustible absorbent material.

LARGE SPILL: Dike far ahead of liquid spill for later disposal. Prevent entry into waterways, sewers, basements or confined areas. (ERG, 2012)

Protective Clothing

Skin: Wear appropriate personal protective clothing to prevent skin contact.

Eyes: Wear appropriate eye protection to prevent eye contact.

Wash skin: The worker should immediately wash the skin when it becomes contaminated.

Remove: Work clothing that becomes wet or significantly contaminated should be removed and replaced.

Change: No recommendation is made specifying the need for the worker to change clothing after the work shift.

Provide: Eyewash fountains should be provided in areas where there is any possibility that workers could be exposed to the substance; this is irrespective of the recommendation involving the wearing of eye protection. Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.] (NIOSH, 2003)

DuPont Tychem® Suit Fabrics

Fabric legend and testing details ▶

Normalized Breakthrough Times (in Minutes)

Chemical	CAS Number	State	QC	SL	TF	TP	C3	BR	LV	RC	TK	RF
Trichloroethylene	79-01-6	Liquid		imm.	>480	>480	>480	>480	>480	>480	>480	>480

> indicates greater than.
"imm." indicates immediate; having a normalized breakthrough time of 10 minutes or less.
A blank cell indicates the fabric has not been tested. The fabric may or may not offer barrier.

Special Warnings from DuPont

1. Serged and bound seams are degraded by some hazardous liquid chemicals, such as strong acids, and should not be worn when these chemicals are present.
2. CAUTION: This information is based upon technical data that DuPont believes to be reliable. It is subject to revision as additional knowledge and experience are gained. DuPont makes no guarantee of results and assumes no obligation or liability...
   More Info... ▶

(DuPont, 2015)

First Aid

EYES: First check the victim for contact lenses and remove if present. Flush victim's eyes with water or normal saline solution for 20 to 30 minutes while simultaneously calling a hospital or poison control center. Do not put any ointments, oils, or medication in the victim's eyes without specific instructions from a physician. IMMEDIATELY transport the victim after flushing eyes to a hospital even if no symptoms (such as redness or irritation) develop.

SKIN: IMMEDIATELY flood affected skin with water while removing and isolating all contaminated clothing. Gently wash all affected skin areas thoroughly with soap and water. IMMEDIATELY call a hospital or poison control center even if no symptoms (such as redness or irritation) develop. IMMEDIATELY transport the victim to a hospital for treatment after washing the affected areas.

INHALATION: IMMEDIATELY leave the contaminated area; take deep breaths of fresh air. IMMEDIATELY call a physician and be prepared to transport the victim to a hospital even if no symptoms (such as wheezing, coughing, shortness of breath, or burning in the mouth, throat, or chest) develop. Provide proper respiratory protection to rescuers entering an unknown atmosphere. Whenever possible, Self-Contained Breathing Apparatus (SCBA) should be used; if not available, use a level of protection greater than or equal to that advised under Protective Clothing.

INGESTION: DO NOT INDUCE VOMITING. Volatile chemicals have a high risk of being aspirated into the victim's lungs during vomiting which increases the medical problems. If the victim is conscious and not convulsing, give 1 or 2 glasses of water to dilute the chemical and IMMEDIATELY call a hospital or poison control center. IMMEDIATELY transport the victim to a hospital. If the victim is convulsing or unconscious, do not give anything by mouth, ensure that the victim's airway is open and lay the victim on his/her side with the head lower than the body. DO NOT INDUCE VOMITING. IMMEDIATELY transport the victim to a hospital.

OTHER: Since this chemical is a known or suspected carcinogen you should contact a physician for advice regarding the possible long term health effects and potential recommendation for medical monitoring. Recommendations from the physician will depend upon the specific compound, its chemical, physical and toxicity properties, the exposure level, length of exposure, and the route of exposure. (NTP, 1992)

Physical Properties

What is this information? ▶

Chemical Formula: C2HCl3

Flash Point: greater than 200 ° F (NTP, 1992)
Lower Explosive Limit (LEL): 12.5 % (NTP, 1992)
Upper Explosive Limit (UEL): 90 % (NTP, 1992)
Autoignition Temperature: 770 ° F (USCG, 1999)
Melting Point: -99 ° F (NTP, 1992)
Vapor Pressure: 60 mm Hg at 68.0 ° F ; 77 mm Hg at 77° F (NTP, 1992)
Vapor Density (Relative to Air): 4.53 (NTP, 1992)
Specific Gravity: 1.46 at 68.0 ° F (USCG, 1999)
Boiling Point: 189 ° F at 760.0 mm Hg (NTP, 1992)
Molecular Weight: 131.4 (NTP, 1992)
Water Solubility: less than 1 mg/mL at 70° F (NTP, 1992)
IDLH: 1000 ppm ; A potential human carcinogen. (NIOSH, 2003)

AEGLs (Acute Exposure Guideline Levels)

Interim AEGLs for Trichloroethylene (79-01-6)

Exposure Period	AEGL-1	AEGL-2	AEGL-3
10 minutes	260 ppm	960 ppm	6100 ppm
30 minutes	180 ppm	620 ppm	6100 ppm
60 minutes	130 ppm	450 ppm	3800 ppm
4 hours	84 ppm	270 ppm	1500 ppm
8 hours	77 ppm	240 ppm	970 ppm

(NAC/NRC, 2014)

ERPGs (Emergency Response Planning Guidelines)

Chemical	ERPG-1	ERPG-2	ERPG-3
Trichloroethylene (79-01-6)	100 ppm ✪	500 ppm	5000 ppm

✪ indicates that odor should be detectable near ERPG-1.
(AIHA, 2014)

PACs (Protective Action Criteria)

Chemical	PAC-1	PAC-2	PAC-3	
Trichloroethylene (79-01-6)	130 ppm	450 ppm	3800 ppm	LEL = 79000 ppm

(SCAPA, 2012)

Regulatory Information

What is this information? ▸

EPA Consolidated List of Lists

Regulatory Name	CAS Number/ 313 Category Code	EPCRA 302 EHS TPQ	EPCRA 304 EHS RQ	CERCLA RQ	EPCRA 313 TRI	RCRA Code	CAA 112 (r) RMP TQ
Trichloroethylene	79-01-6			100	313	U228	

(EPA List of Lists, 2015)

DHS Chemical Facility Anti-Terrorism Standards (CFATS)

No regulatory information available.

Alternate Chemical Names

What is this information? ▸

- ACETYLENE TRICHLORIDE
- ALGYLEN
- ANAMENTH
- BENZINOL
- BLACOSOLV
- BLANCOSOLV
- CECOLENE
- CHLORILEN
- 1-CHLORO-2,2-DICHLOROETHYLENE
- CHLORYLEA
- CHLORYLEN
- CHORYLEN
- CIRCOSOLV
- CRAWHASPOL
- DENSINFLUAT
- 1,1-DICHLORO-2-CHLOROETHYLENE
- DOW-TRI
- DUKERON
- ETHINYL TRICHLORIDE
- ETHYLENE TRICHLORIDE
- ETHYLENE, TRICHLORO-
- F 1120
- FLECK-FLIP
- FLOCK FLIP
- FLUATE
- GEMALGENE
- GERMALGENE
- LANADIN
- LETHURIN
- NARCOGEN
- NARKOGEN
- NARKOSOID
- NCI-C04546
- NIALK
- PERM-A-CHLOR
- PERM-A-CLOR
- PETZINOL
- PHILEX
- R 1120
- TCE
- THRETHYLEN
- THRETHYLENE
- TRETHYLENE
- TRI
- TRI-CLENE
- TRI-PLUS
- TRI-PLUS M
- TRIAD
- TRIAL
- TRIASOL
- TRICHLORAN
- TRICHLOREN
- TRICHLORETHYLENE
- TRICHLOROETHENE
- TRICHLOROETHYLENE
- 1,1,2-TRICHLOROETHYLENE
- 1,2,2-TRICHLOROETHYLENE
- TRICLENE
- TRIELENE
- TRIELIN
- TRIELINE
- TRIKLONE
- TRIKLONE N

- TRILEN
- TRILENE
- TRILINE
- TRIMAR
- TRIOL
- VESTROL
- VITRAN
- WESTROSOL

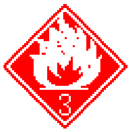
CAMEO Chemicals version 2.4.2.

CDC Centers for Disease Control and Prevention
CDC 24/7: Saving Lives, Protecting People™

Providing National and World Leadership to Prevent Workplace Illnesses and Injuries NIOSH®

m-XYLENE

ICSC: 0085

meta-Xylene 1,3-Dimethylbenzene m-Xylol $C_6H_4(CH_3)_2$ / C_8H_{10} Molecular mass: 106.2 ICSC # 0085 	CAS # 108-38-3 RTECS # ZE2275000 UN # 1307 EC # 601-022-00-9 August 03, 2002 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.	Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE!	
•INHALATION	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.

•EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours.)	Fireproof. Separated from strong oxidants and strong acids .	Note: C Xn symbol R: 10-20/21-38 S: 2-25 UN Hazard Class: 3 UN Packing Group: III

ICSC: 0085	Prepared in the context of cooperation between the International Programme on Chemical Safety & the Commission of the European Communities (C) IPCS CEC 1994. No modifications to the International version have been made except to add the OSHA PELs, NIOSH RELs and NIOSH IDLH values.

ICSC: 0085

m-XYLENE

IMPORTANT DATA

PHYSICAL STATE; APPEARANCE:
COLOURLESS LIQUID , WITH CHARACTERISTIC ODOUR.

PHYSICAL DANGERS:
As a result of flow, agitation, etc., electrostatic charges can be generated.

CHEMICAL DANGERS:
Reacts with strong acids and strong oxidants .

OCCUPATIONAL EXPOSURE LIMITS:
TLV: 100 ppm as TWA; 150 ppm as STEL A4 (ACGIH 2001). BEI specified by (ACGIH 2001).
EU OEL: 50 ppm as TWA; 100 ppm as STEL (skin) (EU 2000).
OSHA PEL†: TWA 100 ppm (435 mg/m^3)
NIOSH REL: TWA 100 ppm (435 mg/m^3) ST 150 ppm (655 mg/m^3)
NIOSH IDLH: 900 ppm See: 95476

ROUTES OF EXPOSURE:
The substance can be absorbed into the body by inhalation, through the skin and by ingestion.

INHALATION RISK:
A harmful contamination of the air will be reached rather slowly on evaporation of this substance at 20°C.

EFFECTS OF SHORT-TERM EXPOSURE:
The substance is irritating to the eyes and the skin . The substance may cause effects on the central nervous system . If this liquid is swallowed, aspiration into the lungs may result in chemical pneumonitis.

EFFECTS OF LONG-TERM OR REPEATED EXPOSURE:
The liquid defats the skin. The substance may have effects on the central nervous system .Exposure to the substance may enhance hearing damage caused by exposure to noise. Animal tests show that this substance possibly causes toxicity to human reproduction or development.

PHYSICAL PROPERTIES

Boiling point: 139°C
Melting point: -48°C
Relative density (water = 1): 0.86
Solubility in water: none
Vapour pressure, kPa at 20°C: 0.8
Relative vapour density (air = 1): 3.7
Relative density of the vapour/air-mixture at 20°C (air = 1): 1.02
Flash point: 27°C c.c.
Auto-ignition temperature: 527°C
Explosive limits, vol% in air: 1.1-7.0
Octanol/water partition coefficient as log Pow: 3.20

ENVIRONMENTAL DATA

The substance is toxic to aquatic organisms.

NOTES

Depending on the degree of exposure, periodic medical examination is indicated. The recommendations on this Card also apply to technical xylene. See ICSC 0084 o-Xylene and 0086 p-Xylene.

NFPA Code: H 2; F 3; R 0;

Transport Emergency Card: TEC (R)-30S1307-III
Card has been partially updated in January 2008: see Occupational Exposure Limits.

ADDITIONAL INFORMATION

ICSC: 0085 **m-XYLENE**

IMPORTANT LEGAL NOTICE:

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Page last reviewed: July 22, 2015

Page last updated: July 1, 2014

Content source: Centers for Disease Control and Prevention (http://www.cdc.gov/)

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Control and Prevention
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NIOSH®

p-XYLENE

ICSC: 0086

para-Xylene
1,4-Dimethylbenzene
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Molecular mass: 106.2
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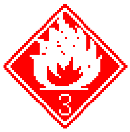

CAS # 106-42-3
RTECS # ZE2625000
UN # 1307
EC # 601-022-00-9
August 03, 2002 Validated

TYPES OF HAZARD/ EXPOSURE	ACUTE HAZARDS/ SYMPTOMS	PREVENTION	FIRST AID/ FIRE FIGHTING
FIRE	Flammable.	NO open flames, NO sparks, and NO smoking.	Powder, water spray, foam, carbon dioxide.
EXPLOSION	Above 27°C explosive vapour/air mixtures may be formed.	Above 27°C use a closed system, ventilation, and explosion-proof electrical equipment. Prevent build-up of electrostatic charges (e.g., by grounding).	In case of fire: keep drums, etc., cool by spraying with water.
EXPOSURE		STRICT HYGIENE! AVOID EXPOSURE OF (PREGNANT) WOMEN!	
•INHALATION	Dizziness. Drowsiness. Headache. Nausea.	Ventilation, local exhaust, or breathing protection.	Fresh air, rest. Refer for medical attention.
•SKIN	Dry skin. Redness.	Protective gloves.	Remove contaminated clothes. Rinse and then wash skin with water and soap.

•EYES	Redness. Pain.	Safety spectacles.	First rinse with plenty of water for several minutes (remove contact lenses if easily possible), then take to a doctor.
•INGESTION	Burning sensation. Abdominal pain. (Further see Inhalation).	Do not eat, drink, or smoke during work.	Rinse mouth. Do NOT induce vomiting. Refer for medical attention.

SPILLAGE DISPOSAL	STORAGE	PACKAGING & LABELLING
Ventilation. Remove all ignition sources. Collect leaking and spilled liquid in sealable containers as far as possible. Absorb remaining liquid in sand or inert absorbent and remove to safe place. Do NOT let this chemical enter the environment. (Extra personal protection: filter respirator for organic gases and vapours.)	Fireproof. Separated from strong oxidants and strong acids .	Note: C Xn symbol R: 10-20/21-38 S: 2-25 UN Hazard Class: 3 UN Packing Group: III

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ICSC: 0086

p-XYLENE

IMPORTANT DATA

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ENVIRONMENTAL DATA	The substance is toxic to aquatic organisms.	

N O T E S

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