Common Name: BENZENE

Synonyms: Benzin; Benzol; Phenyl Hydride
Chemical Name: Benzene
Date: October 2008  Revision: July 2015

CAS Number: 71-43-2
RTK Substance Number: 0197
DOT Number: UN 1114

Description and Use

Benzene is a clear, colorless liquid with a sweet Petroleum-like odor. It is used as a solvent and in making plastics, resins, dyes and pesticides. It is also found in Gasoline.

- ODOR THRESHOLD= 12 ppm
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

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

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.

Hazard Summary

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>NJDHSS</th>
<th>NFPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>HEALTH</td>
<td>4</td>
<td>2</td>
</tr>
<tr>
<td>FLAMMABILITY</td>
<td>-</td>
<td>3</td>
</tr>
<tr>
<td>REACTIVITY</td>
<td>-</td>
<td>0</td>
</tr>
<tr>
<td>CARCINOGEN</td>
<td>FLAMMABLE</td>
<td></td>
</tr>
<tr>
<td>POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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

- Benzene can affect you when inhaled and by passing through the skin.
- Benzene is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- Benzene can irritate the skin and eyes with drying and scaling of the skin.
- Inhaling Benzene can irritate the nose and throat.
- Benzene can cause headache, dizziness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).
- Benzene is a FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is 1 ppm averaged over an 8-hour workshift and 5 ppm, not to be exceeded during any 15-minute work period.

NIOSH: The recommended airborne exposure limit (REL) is 0.1 ppm averaged over a 10-hour workshift and 1 ppm, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is 0.5 ppm averaged over an 8-hour workshift and 2.5 ppm as a STEL (short-term exposure limit).

- Benzene 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.
- 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 (http://nj.gov/health/workplacehealthandsafety/right-to-know/) 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 Benzene:

- Contact can irritate the skin and eyes.
- Inhaling Benzene can irritate the nose and throat causing coughing and wheezing.
- Benzene can cause headache, dizziness, lightheadedness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.

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

Cancer Hazard
- Benzene is a CARCINOGEN in humans. It has been shown to cause leukemia.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- There is limited evidence that Benzene is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

Other Effects
- Benzene can cause drying and scaling of the skin.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).

Medical

Medical Testing
Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than 0.5 ppm of Benzene) a work and medical history and exam, which shall include:

- Thorough physical examination
- Complete blood count (CBC)
- Any other tests determined necessary by the examining physician

OSHA requires your employer to provide you and your doctor with a copy of the OSHA Benzene Standard (29 CFR 1910.1028).

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:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA Benzene Standard (29 CFR 1910.1028).
- Before entering a confined space where Benzene may be present, check to make sure that an explosive concentration does not exist.

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 Benzene. 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 Polyvinyl Alcohol, Silver Shield®4H®, Viton and Fluoroelastomer for gloves and Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC, or the equivalent, as protective materials for Hydrocarbons, Aromatic.

Eye Protection

- 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 non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has 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 0.5 ppm, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. 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 Benzene, (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 5 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 500 ppm is immediately dangerous to life and health. If the possibility of exposure above 500 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.
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).

- Benzene is a FLAMMABLE LIQUID.
- Use dry chemical, CO₂, water spray or foam as extinguishing agents.
- Use water as fog, as spray may be ineffective and may scatter and spread fire.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to reduce vapors and keep containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapors are heavier than air and may travel a distance to cause a fire or explosion far from the source.

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 Benzene 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 area of spill or leak.
- Keep Benzene out of confined spaces, such as sewers, because of the possibility of an explosion.
- Use water spray to reduce vapors and keep containers cool.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of Benzene 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 Benzene you should be trained on its proper handling and storage.

- A regulated, marked area should be established where Benzene is handled, used or stored as required by the OSHA Benzene Standard (29 CFR 1910.1028).
- Benzene reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Benzene ignites on contact with CHROMIC ANHYDRIDE.
- Benzene is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.
- Store in tightly closed containers in a cool, well-ventilated area away from AIR and HEAT.

- Benzene attacks some RUBBER, COATINGS and PLASTICS.
- Sources of ignition, such as smoking and open flames, are prohibited where Benzene is used, handled, or stored.
- Metal containers involving the transfer of Benzene should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever Benzene is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of Benzene.

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

For more information, please contact:

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

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/m³ means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

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

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

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

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

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

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

Permeated is the movement of chemicals through protective materials.

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

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

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

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

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

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

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

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

Synonyms: Benzin; Benzol; Phenyl Hydride
CAS No: 71-43-2
Molecular Formula: C₆H₆
RTK Substance No: 0197
Description: Clear, colorless liquid with a sweet Petroleum-like odor

HAZARD DATA

<table>
<thead>
<tr>
<th>Hazard Rating</th>
<th>Firefighting</th>
<th>Reactivity</th>
</tr>
</thead>
<tbody>
<tr>
<td>4 - Health</td>
<td>FLAMMABLE LIQUID Use dry chemical, CO₂, water spray or foam as extinguishing agents. Use water as fog, as spray may be ineffective and may scatter and spread fire.</td>
<td>Benzene reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC). Benzene ignites on contact with CHROMIC ANHYDRIDE. Benzene is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.</td>
</tr>
<tr>
<td>3 - Fire</td>
<td>POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to reduce vapors and keep containers cool. Vapors may travel to a source of ignition and flash back. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.</td>
<td></td>
</tr>
<tr>
<td>0 - Reactivity</td>
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DOT#: UN 1114
ERG Guide #: 130
Hazard Class: 3 (Flammable)

PHYSICAL PROPERTIES

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<thead>
<tr>
<th>Property</th>
<th>Value</th>
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<tbody>
<tr>
<td>Odor Threshold:</td>
<td>12 ppm</td>
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<tr>
<td>Flash Point:</td>
<td>12°F (-11°C)</td>
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<tr>
<td>LEL:</td>
<td>1%</td>
</tr>
<tr>
<td>UEL:</td>
<td>8%</td>
</tr>
<tr>
<td>Auto Ignition Temp:</td>
<td>928°F to 1,076°F (498°C to 580°C)</td>
</tr>
<tr>
<td>Vapor Density:</td>
<td>2.7 (air = 1)</td>
</tr>
<tr>
<td>Vapor Pressure:</td>
<td>75 mm Hg at 68°F (20°C)</td>
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<tr>
<td>Specific Gravity:</td>
<td>0.88 (water = 1)</td>
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<tr>
<td>Water Solubility:</td>
<td>Slightly soluble</td>
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<tr>
<td>Boiling Point:</td>
<td>176°F (80°C)</td>
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<td>Freezing Point:</td>
<td>42°F (6°C)</td>
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<td>Ionization Potential:</td>
<td>9.24 eV</td>
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<tr>
<td>Molecular Weight:</td>
<td>78.1</td>
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EXPOSURE LIMITS

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<tr>
<th>Limit Type</th>
<th>Value</th>
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<tbody>
<tr>
<td>OSHA:</td>
<td>1 ppm, 8-hr TWA; 5 ppm, 15-min STEL</td>
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<tr>
<td>NIOSH:</td>
<td>0.1 ppm, 10-hr TWA; 1 ppm, 15-min STEL</td>
</tr>
<tr>
<td>ACGIH:</td>
<td>0.5 ppm, 8-hr TWA; 2.5 ppm, 15-min STEL</td>
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<tr>
<td>IDLH:</td>
<td>500 ppm</td>
</tr>
<tr>
<td>ERPG-1:</td>
<td>50 ppm</td>
</tr>
<tr>
<td>ERPG-2:</td>
<td>150 ppm</td>
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<tr>
<td>ERPG-3:</td>
<td>1,000 ppm</td>
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<tr>
<td>ERPG:</td>
<td>50 ppm</td>
</tr>
<tr>
<td>ERPL:</td>
<td>150 ppm</td>
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<tr>
<td>ERPC:</td>
<td>1,000 ppm</td>
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PROTECTIVE EQUIPMENT

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<tr>
<th>Equipment</th>
<th>Description</th>
</tr>
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<tbody>
<tr>
<td>Gloves:</td>
<td>Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Fluoroelastomer (&gt;8-hr breakthrough)</td>
</tr>
<tr>
<td>Coveralls:</td>
<td>Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC (&gt;8-hr breakthrough for Hydrocarbons, Aromatic)</td>
</tr>
<tr>
<td>Respirator:</td>
<td>&gt;0.5 ppm - Supplied air or SCBA</td>
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HEALTH EFFECTS

<table>
<thead>
<tr>
<th>Exposure Type</th>
<th>Effects</th>
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</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>IRRITATION</td>
</tr>
<tr>
<td>Skin:</td>
<td>IRRITATION</td>
</tr>
<tr>
<td>Inhalation:</td>
<td>Nose and throat irritation with coughing and wheezing</td>
</tr>
<tr>
<td></td>
<td>Headache, dizziness, convulsions and coma</td>
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<tr>
<td>Chronic:</td>
<td>Cancer (leukemia) in humans</td>
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</table>

FIRST AID AND DECONTAMINATION

<table>
<thead>
<tr>
<th>First Aid</th>
<th>Instructions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Eyes:</td>
<td>Remove the person from exposure.</td>
</tr>
<tr>
<td>Skin:</td>
<td>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.</td>
</tr>
<tr>
<td>Respirator:</td>
<td>&gt;0.5 ppm - Supplied air or SCBA</td>
</tr>
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July 2015