

Common Name: **VINYL CHLORIDE**

Synonyms: Chloroethylene; Monochloroethylene; VCM

Chemical Name: Ethene, Chloro-

Date: November 2010      Revision: October 2015

CAS Number: 75-01-4

RTK Substance Number: 2001

DOT Number: UN 1086

### Description and Use

**Vinyl Chloride** is a colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure. It is used to make *Polyvinyl Chloride* for pipes, wire, and cable coatings, and in furniture, automobiles, and adhesives.

- ▶ **ODOR THRESHOLD = >3,000 ppm**
- ▶ Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

### Reasons for Citation

- ▶ **Vinyl Chloride** 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.

[SEE GLOSSARY ON PAGE 5.](#)

### FIRST AID

#### Eye Contact

- ▶ Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

#### Skin Contact

- ▶ Immerse affected part in warm 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
<b>HEALTH</b>	4	2
<b>FLAMMABILITY</b>	4	4
<b>REACTIVITY</b>	2	2
CARCINOGEN FLAMMABLE AND REACTIVE POISONOUS GASES ARE PRODUCED IN FIRE CONTAINERS MAY EXPLODE IN FIRE		

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

- ▶ **Vinyl Chloride** can affect you when inhaled.
- ▶ **Vinyl Chloride** is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- ▶ **Vinyl Chloride** can cause reproductive damage.
- ▶ Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- ▶ Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs.
- ▶ **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.
- ▶ Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- ▶ Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hands (Raynaud's Syndrome).
- ▶ **Vinyl Chloride** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.
- ▶ EXPLOSIVE POLYMERIZATION may occur at elevated temperatures if **Vinyl Chloride** is not inhibited.

#### 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: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **1 ppm** averaged over an 8-hour workshift.

**Vinyl Chloride** 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 (<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 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 **Vinyl Chloride**:

- ▶ Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- ▶ Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- ▶ **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.

### Chronic Health Effects

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

### Cancer Hazard

- ▶ **Vinyl Chloride** is a CARCINOGEN in humans. It has been shown to cause liver, brain, lung, and other types of cancer.
- ▶ Many scientists believe there is no safe level of exposure to a carcinogen.

### Reproductive Hazard

- ▶ **Vinyl Chloride** may damage the developing fetus.
- ▶ There is limited evidence that **Vinyl Chloride** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.
- ▶ There is limited evidence that **Vinyl Chloride** may damage the male reproductive system (including decreasing the sperm count) and may affect male fertility.
- ▶ An excess of spontaneous abortions has been reported among spouses of workers who had been exposed to **Vinyl Chloride**.

### Other Effects

- ▶ Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- ▶ Repeated exposure can cause a disease called "scleroderma." This causes the skin to become very smooth, tight and shiny. It causes the bones of the fingers to erode (acro-osteolysis), and damages the blood vessels in the hands or feet (Raynaud's syndrome). This causes the fingers or toes to turn numb, pale or blue, with even mild cold exposure.

## Medical

### Medical Testing

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

- ▶ Liver function tests
- ▶ Chest x-ray and lung function tests

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

- ▶ Exam of the nervous system
- ▶ Exam of the skin

OSHA requires your employer to provide you and your doctor with a copy of the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).

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 **Vinyl Chloride**.

## 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/](http://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 **Vinyl Chloride** Standard (29 CFR 1910.1017).
- ▶ Before entering a confined space where **Vinyl Chloride** may be present, check to make sure that an explosive concentration does not exist.
- ▶ Transfer **Vinyl Chloride** from cylinders 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 **Vinyl Chloride**. 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 for **Vinyl Chloride** are Viton, Viton/Butyl, Silver Shield®/4H® and Barrier®.

- ▶ The recommended protective clothing materials for **Vinyl Chloride** are Tychem® BR, CSM and TK; and Trelchem® HPS and VPS or the equivalent.
- ▶ Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with *insulated* gloves and special clothing designed to prevent the freezing of body tissues.
- ▶ All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

### Eye Protection

- ▶ 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 **1 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 or an emergency escape air cylinder.
- ▶ **DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.**

## 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).

- ▶ **Vinyl Chloride** is a FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited.
- ▶ DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.
- ▶ Use dry chemical or CO<sub>2</sub> for small fires.
- ▶ POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- ▶ CONTAINERS MAY EXPLODE IN FIRE.
- ▶ Use water spray to reduce vapors and to keep containers cool.
- ▶ Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back.
- ▶ Flow or agitation may generate electrostatic charges.
- ▶ **Vinyl Chloride** may form an ignitable vapor/air mixture in closed tanks or containers.

### 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 **Vinyl Chloride** is leaked, take the following steps:

- ▶ Evacuate personnel and secure and control entrance to the area.
- ▶ Eliminate ignition sources.
- ▶ Ventilate area of leak to disperse the gas.
- ▶ Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- ▶ Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- ▶ Turn leaking cylinder with leak up to prevent escape of gas in liquid state.
- ▶ Ventilate area of spill or leak.
- ▶ Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.
- ▶ DO NOT wash into sewer.
- ▶ It may be necessary to contain and dispose of **Vinyl Chloride** 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 **Vinyl Chloride** you should be trained on its proper handling and storage.

- ▶ A regulated, marked area should be established where **Vinyl Chloride** is handled, used or stored as required by the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).
- ▶ **Vinyl Chloride** can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST.
- ▶ **Vinyl Chloride** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- ▶ **Vinyl Chloride** is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur.
- ▶ *Phenol* should be used as an inhibitor to prevent violent polymerization of **Vinyl Chloride**.
- ▶ Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE, HEAT SOURCES and METALS.
- ▶ Sources of ignition, such as smoking and open flames, are prohibited where **Vinyl Chloride** is used, handled, or stored.
- ▶ Metal containers involving the transfer of **Vinyl Chloride** should be grounded and bonded.
- ▶ Use explosion-proof electrical equipment and fittings wherever **Vinyl Chloride** is used, handled, manufactured, or stored.
- ▶ Use only non-sparking tools and equipment, especially when opening and closing containers of **Vinyl Chloride**.
- ▶ **Vinyl Chloride** may accumulate static electricity.

### 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.nj.gov](mailto: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 (AEGs)** 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<sup>3</sup>** 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 AEGs 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.

**Common Name: VINYL CHLORIDE**

Synonyms: Chloroethylene; Monochloroethylene; VCM

CAS No: 75-01-4

Molecular Formula: CH<sub>2</sub> = CHCl

RTK Substance No: 2001

Description: Colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure

## HAZARD DATA

Hazard Rating	Firefighting	Reactivity
<p><b>4 - Health</b></p> <p><b>4 - Fire</b></p> <p><b>2 - Reactivity</b></p> <p><b>DOT#:</b> UN 1086</p> <p><b>ERG Guide #:</b> 116P</p> <p><b>Hazard Class:</b> 2.1 (Flammable Gas)</p>	<p>FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited.</p> <p>DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.</p> <p>Use dry chemical or CO<sub>2</sub> for small fires.</p> <p>POISONOUS GASES ARE PRODUCED IN FIRE, including <i>Hydrogen Chloride</i> and <i>Phosgene</i>.</p> <p>CONTAINERS MAY EXPLODE IN FIRE.</p> <p>Use water spray to reduce vapors and to keep containers cool.</p> <p>Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back.</p> <p>Flow or agitation may generate electrostatic charges.</p> <p><b>Vinyl Chloride</b> may form an ignitable vapor/air mixture in closed tanks or containers.</p>	<p><b>Vinyl Chloride</b> can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST.</p> <p><b>Vinyl Chloride</b> reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).</p> <p><b>Vinyl Chloride</b> is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur.</p> <p><i>Phenol</i> should be used as an inhibitor to prevent violent polymerization of <b>Vinyl Chloride</b>.</p> <p><b>Vinyl Chloride</b> may accumulate static electricity.</p>

## SPILL/LEAKS

**Isolation Distance:**  
 Spill: 100 meters (330 feet)  
 Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

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

Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.

Turn leaking cylinder with leak up to prevent escape of gas in liquid state.

Use non-sparking tools and ground and bond containers when transferring **Vinyl Chloride**.

**Vinyl Chloride** is hazardous to the environment.

## PHYSICAL PROPERTIES

**Odor Threshold:** >3,000 ppm

**Flash Point:** -108°F (-78°C)

**LEL:** 3.6%

**UEL:** 33%

**Auto Ignition Temp:** 882°F (472°C)

**Vapor Density:** 2.2 (air = 1)

**Vapor Pressure:** 2,524 mm Hg at 68°F (20°C)

**Specific Gravity:** 0.9 (water = 1)

**Water Solubility:** Very slightly soluble

**Boiling Point:** 17°F (-8.3°C)

**Freezing Point:** -245° to -256°F (-154° to -160°C)

**Ionization Potential:** 9.99 eV

**Critical Temperature:** 306° to 317.3°F (152° to 158.5°C)

**Molecular Weight:** 62.5

## EXPOSURE LIMITS

**OSHA:** 1 ppm, 8-hr TWA; 5 ppm, Ceiling

**NIOSH:** Lowest feasible concentration

**ACGIH:** 1 ppm, 8-hr TWA

The Protective Action Criteria values are:  
 PAC-1 = 250 ppm    PAC-2 = 1,200 ppm  
 PAC-3 = 4,800 ppm

## PROTECTIVE EQUIPMENT

**Gloves:** Insulated Viton, Viton/Butyl, Silver Shield®/4H® and Barrier® (>8-hr breakthrough)

**Coveralls:** Tychem® BR, CSM and TK; Trelchem HPS and VPS (8-hr breakthrough)  
>10% of the LEL wear flash protection or turnout gear

**Respirator:** SCBA

## HEALTH EFFECTS

**Eyes:** Irritation and burns, contact with *liquid* or *gas* may cause frostbite

**Skin:** Irritation and burns, contact with *liquid* or *gas* may cause frostbite

**Inhalation:** Nose, throat and lung irritation with coughing, wheezing and shortness of breath  
Headache, dizziness, lightheadedness and passing out

**Chronic:** Cancer (liver, brain, and lung) in humans

## FIRST AID AND DECONTAMINATION

**Remove** the person from exposure.

**Flush** eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention.

**Immerse** affected part in warm water. Seek medical attention.

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

**Transfer** promptly to a medical facility.