

Occupational Health Guideline for Chloroprene

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- **Formula:** $\text{CH}_2=\text{CClCH}=\text{CH}_2$
- **Synonyms:** 2-Chloro-1,3-butadiene; chlorobutadiene; beta-chloroprene
- **Appearance and odor:** Colorless liquid with an ether-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for chloroprene is 25 parts of chloroprene per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 90 milligrams of chloroprene per cubic meter of air (mg/m^3). NIOSH has recommended that the permissible exposure limit be reduced to $3.6 \text{ mg}/\text{m}^3$ (1 ppm) measured over a 15-minute period, and that chloroprene be regulated as an occupational carcinogen. The NIOSH Criteria Document for Chloroprene should be consulted for more detailed information.

HEALTH HAZARD INFORMATION

• Routes of exposure

Chloroprene can affect the body if it is inhaled, if it comes in contact with the eyes or skin, or if it is swallowed. It may be absorbed through the skin.

• Effects of overexposure

Exposure to chloroprene may irritate and damage the eyes. It may also irritate the nose and throat and cause a skin rash. In addition, it may cause nervousness, irritability, and temporary loss of hair. Exposure to chloroprene has been reported to cause cancer of the skin and

the lung. It may also exert embryotoxic and fetotoxic effects and may interfere with reproductive processes.

• Reporting signs and symptoms

A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to chloroprene.

• Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to chloroprene at potentially hazardous levels:

1. Initial Medical Examination:

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the respiratory system, skin, and eyes should be stressed. The skin should be examined for evidence of chronic disorders and cancer. A medical warning should be given to employees, noting that chloroprene exposure has been experimentally linked with reproduction abnormalities such as low sperm count and adverse effects on pregnancy. The relevance to humans of some of these findings has not yet been established.

—14" x 17" chest roentgenogram: Chloroprene may cause an increased incidence of lung cancer in workers. Surveillance of the lungs is indicated.

—FVC and FEV (1 sec): Chloroprene may cause lung damage after long-term exposure. Persons with impaired pulmonary function may be at increased risk from exposure. Periodic surveillance is indicated.

—Skin disease: Chloroprene is a defatting agent and can cause dermatitis on prolonged exposure. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.

—Eye disease: Chloroprene is a severe eye irritant and may cause tissue damage. Those with pre-existing eye problems may be at increased risk from exposure.

2. Periodic Medical Examination: The aforementioned medical examinations should be repeated on an annual basis.

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

• Summary of toxicology

Chloroprene vapor irritates the mucous membranes and skin, and may have teratogenic and carcinogenic properties. Rats died from repeated daily exposure to 1.2 mg/l (330 ppm), with damage to lungs, liver, and kidneys. Higher concentrations caused anesthesia and respiratory paralysis. Daily animal exposures of 0.3 mg/l (83 ppm) were tolerated for 13 weeks. Chloroprene has been reported to have an effect on embryogenesis in animals; in rats and mice, there was an increase in total embryonal mortality and a reduction in the fetal weight of offspring of females exposed during pregnancy. Conjunctivitis and focal necrosis of the cornea have been reported in workers. Excessive nervousness and irritability have been observed. Skin exposures cause dermatitis and, occasionally, a peculiar focal alopecia of the scalp which is reversible. Two recent reports suggest that chloroprene exposure is associated with an increased incidence of cancer of the skin and of the lungs.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 88.5
2. Boiling point (760 mm Hg): 58.9 C (138 F)
3. Specific gravity (water = 1): 0.96
4. Vapor density (air = 1 at boiling point of chloroprene): 3.0
5. Melting point: -130 C (-202 F)
6. Vapor pressure at 20 C (68 F): 179 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

Insoluble

8. Evaporation rate (butyl acetate = 1): Data not available

• Reactivity

1. Conditions contributing to instability: Temperatures above -15 C (5 F)

2. Incompatibilities: Contact with peroxides and other oxidizers may cause polymerization with evolution of heat and rupture of containers.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride and carbon monoxide) may be released in a fire involving chloroprene.

4. Special precautions: Chloroprene will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: -20 C (-4 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Lower: 4.0; Upper: 20.0

4. Extinguishant: Foam, dry chemical, carbon dioxide

• Warning properties

No quantitative data are available relating the warning properties of chloroprene to air concentrations. Therefore, it is treated as a material with poor warning properties. Chloroprene is an irritant, as noted by Patty.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

An analytical method for chloroprene is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to use impervious clothing, gloves, face shields (eight-inch minimum), and other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid chloroprene.

• Clothing contaminated with liquid chloroprene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of chloroprene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the chloroprene, the person performing the operation should be informed of chloroprene's hazardous properties.

• Any clothing which becomes wet with liquid chloroprene should be removed immediately and not reworn until the chloroprene is removed from the clothing.

- Employees should be provided with and required to use splash-proof safety goggles where liquid chloroprene may contact the eyes.

SANITATION

- Skin that becomes contaminated with liquid chloroprene should be promptly washed or showered with soap or mild detergent and water to remove any chloroprene.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to chloroprene may occur and control methods which may be effective in each case:

Operation	Controls
Use in manufacture of a variety of neoprene elastomers; use in manufacture of neoprene latex which might retain unpolymerized chloroprene	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If chloroprene gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If chloroprene gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If chloroprene soaks through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of chloroprene, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.

• Swallowing

When chloroprene has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• Rescue

Move the affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

- If chloroprene is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for evaporating vapors to completely clear the hood ductwork. Burn the paper in a suitable location away from combustible materials. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Chloroprene should not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive concentrations of chloroprene vapors are permitted.

- Waste disposal method:

Chloroprene may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

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RESPIRATORY PROTECTION FOR CHLOROPRENE

Condition	Minimum Respiratory Protection* Required Above 25 ppm
Vapor Concentration	
400 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 400 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

*Only NIOSH-approved or MSHA-approved equipment should be used.