

Occupational Health Guideline for Hexachloroethane*

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: CCl_2CCl_2
- Synonyms: Perchloroethane
- Appearance and odor: Colorless solid with a camphor-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for hexachloroethane is 1 part of hexachloroethane per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 10 milligrams of hexachloroethane per cubic meter of air (mg/m^3). The American Conference of Governmental Industrial Hygienists has issued a Notice of Intended Changes of their recommended Threshold Limit Value for hexachloroethane from 1 ppm to 10 ppm with a skin notation.

HEALTH HAZARD INFORMATION

• Routes of exposure

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

• Effects of overexposure

Exposure to the hot fumes of hexachloroethane may cause irritation of the eyes.

• 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 hexachloroethane. employee who is exposed to hexachloroethane at potentially hazardous levels.

• Recommended medical surveillance

Routine medical examinations should be provided to each employee who is exposed to hexachloroethane at potentially hazardous levels.

• Summary of toxicology

Hexachloroethane is an eye irritant. High oral doses in animals cause hepatic, renal, and central nervous system effects. Dogs given oral doses of 1 to 1.4 g/kg showed depression of the central nervous system characterized by weakness, staggering, and muscle twitching. When administered orally to domestic animals as a parasiticide, it caused chronic lesions in the liver and acute, diffuse nephrosis in cattle at high doses, but it had no noticeable toxic effect in horses at levels of 0.2 g/kg. Exposure of workmen to fumes from hot hexachloroethane resulted in blepharospasm, photophobia, lacrimation, and reddening of the conjunctiva, but no corneal injury or permanent damage. No chronic effects have been reported from industrial exposure, although significant absorption through the skin is said to occur.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 236.7
2. Boiling point (760 mm Hg): 189 °C (372 F) (sublimes)
3. Specific gravity (water = 1): 2.1
4. Vapor density (air = 1 at boiling point of hexachloroethane): 8.2
5. Melting point: 189 °C (372 F) (sealed tube)
6. Vapor pressure at 20 °C (68 F): 0.22 mm Hg
7. Solubility in water, g/100 g water at 20 °C (68 F): 0.005
8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity

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.

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Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
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1. Conditions contributing to instability: Heat
2. Incompatibilities: Hexachloroethane reacts with hot iron, zinc, and aluminum. Dehalogenation by reaction with alkalis will produce spontaneously explosive chloroacetylene.

3. Hazardous decomposition products: Toxic gases and vapors (such as phosgene, chlorine, carbon tetrachloride, and tetrachloroethylene) may be released when hexachloroethane decomposes.

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

- **Flammability**

1. Not combustible

- **Warning properties**

Although hexachloroethane has a camphor-like odor, no quantitative data are available relating air concentrations of this substance to warning properties.

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**

Sampling and analyses may be performed by collection of hexachloroethane vapors using an adsorption tube with subsequent desorption with carbon disulfide and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure hexachloroethane may be used. An analytical method for hexachloroethane 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 repeated or prolonged skin contact with solid hexachloroethane or liquids containing hexachloroethane.

- If employees' clothing may have become contaminated with solid hexachloroethane or liquids containing hexachloroethane, employees should change into uncontaminated clothing before leaving the work premises.

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

- Non-impervious clothing which becomes contaminated with solid hexachloroethane or liquids containing hexachloroethane should be removed promptly and not reworn until the hexachloroethane is removed from the clothing.

SANITATION

- Workers subject to skin contact with solid hexachloroethane or liquids containing hexachloroethane should wash with soap or mild detergent and water any areas of the body which may have contacted hexachloroethane at the end of each work day.

- Skin that becomes contaminated with solid hexachloroethane or liquids containing hexachloroethane should be promptly washed or showered with soap or mild detergent and water to remove any hexachloroethane.

- Employees who handle solid hexachloroethane or liquids containing hexachloroethane should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

- Eating and smoking should not be permitted in areas where solid hexachloroethane or liquids containing hexachloroethane are handled, processed, or stored.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to hexachloroethane may occur and

control methods which may be effective in each case:

Operation	Controls
Use in manufacture of pyrotechnics	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use in lubricants in foundries for mold treatment; extreme-pressure lubricants; use in preparation of nitrocellulose esters camphor substitutes; use as a fumigant, insecticide, fungicide, and animal antihelmintics; use as a modifier in manufacture of synthetic rubber	General dilution ventilation; local exhaust ventilation; personal protective equipment
Use as a chemical additive; use to reduce ignitability of combustibles, and as submarine paint to prevent corrosion; as an additive to fire extinguishers	General dilution ventilation; local exhaust 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 hexachloroethane gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation is present after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

• Skin Exposure

If hexachloroethane gets on the skin, immediately wash the contaminated skin using soap or mild detergent and water. If liquids containing hexachloroethane soak through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation is present after washing, get medical attention.

• Breathing

If a person breathes in large amounts of hexachloroethane, 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 immediately.

• Swallowing

When hexachloroethane 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 AND DISPOSAL PROCEDURES

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

- If hexachloroethane is spilled, the following steps should be taken:

1. Ventilate area of spill.

2. Collect spilled material in the most convenient and safe manner for reclamation or for disposal in a secured sanitary landfill. Liquid containing hexachloroethane should be absorbed in vermiculite, dry sand, earth, or a similar material.

- Waste disposal method:

Hexachloroethane may be disposed of in a secured sanitary landfill.

REFERENCES

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* SPECIAL NOTE

The International Agency for Research on Cancer (IARC) has evaluated the data on this chemical and has concluded that it causes cancer. See *IARC Monographs on the Evaluation of Carcinogenic Risk of Chemicals to Man*, Volume 20, 1979.

RESPIRATORY PROTECTION FOR HEXACHLOROETHANE

Condition	Minimum Respiratory Protection* Required Above 1 ppm
Vapor Concentration	
10 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
50 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
300 ppm or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 300 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 pesticide respirator providing protection against pesticides. Any escape self-contained breathing apparatus.

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