

# Occupational Health Guideline for Chlordane\*

## 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:  $C_{10}H_8Cl_2$  (approx.)
- Synonyms: 1,2,4,5,6,7,8-Octachloro-3a,4,7,7a-tetrahydro-4,7-methanoindane; 1,2,4,5,6,7,8,8-octachloro-2,3,3a,4,7,7a-hexahydro-4,7-methanoindene
- Appearance and odor: Thick amber liquid with a characteristic chlorine-like odor.

## PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for chlordane is 0.5 milligram of chlordane per cubic meter of air ( $mg/m^3$ ) averaged over an eight-hour work shift.

## HEALTH HAZARD INFORMATION

- **Routes of exposure**  
Chlordane 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 enter the body through the skin.
- **Effects of overexposure**  
Exposure to chlordane may cause shaking, blurred vision, irritability, confusion, delirium, staggering, convulsions, and death. Swallowing chlordane may also cause nausea, vomiting, and diarrhea. Chlordane exposure may cause kidney and liver damage. Absorption of chlordane through the skin is rapid and has resulted in death.
- **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 chlordane.

### • Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to chlordane 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. Persons with a history of convulsive disorders would be expected to be at increased risk from exposure. Examination of the nervous system, eyes, lungs, liver, and kidneys should be stressed. The skin should be examined for evidence of chronic disorders.

—Urinalysis: Since kidney damage has been observed in humans exposed to chlordane, a urinalysis should be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

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

#### • Summary of toxicology

Chlordane predominantly affects the central nervous system, causing irritability, tremors, and convulsions. Chronic effects are reported in animals. Repeated oral administration to rabbits indicated a cumulative action at daily doses above 5 mg/kg; autopsy revealed focal necrosis of the liver, degenerative changes in the proximal convoluted tubules, pulmonary exudates and gastrointestinal irritation. In humans, inhalation and skin absorption have resulted in blurred vision, cough, confusion, ataxia, and delirium; ingestion has caused abdominal pain, nausea, vomiting, and diarrhea; severe intoxication has caused irritability, tremor, convulsions, and death. A suicidal person who ingested 6 g (104 mg/kg) of chlordane in talc suffered burns of the mouth, severe gastritis, diffuse pneumonia, anuria, mania, and convulsions; death occurred after 9.5 days; autopsy findings were severe necrotizing bronchopneumonia

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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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and degeneration of renal tubule epithelium. Skin absorption of chlordane is rapid; a worker who spilled a 25% suspension of chlordane on clothing, which was not removed, began having convulsions 40 minutes later and died shortly thereafter. Technical-grade chlordane is stated to be irritating to the skin and mucous membranes, but this may be due to the presence of unreacted chemical intermediates.

## CHEMICAL AND PHYSICAL PROPERTIES

### • Physical data

1. Molecular weight: 409.8 (approx).
2. Boiling point (760 mm Hg): (Decomposes); 175 C (347 F) (at 2 mm Hg)
3. Specific gravity (water = 1): 1.57–1.67
4. Vapor density (air = 1 at boiling point of chlordane): 14
5. Melting point: Data not available
6. Vapor pressure at 20 C (68 F): 0.00001 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

8. Evaporation rate (butyl acetate = 1): Not applicable

### • Reactivity

1. Conditions contributing to instability: Temperatures above 200 C (392 F) cause decomposition with formation of chlorine and hydrogen chloride gases.

2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.

3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, chlorine, phosphine, and carbon monoxide) may be released when chlordane decomposes.

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

### • Flammability

1. Not combustible

### • Warning properties

Since chlordane has such a low vapor pressure, warning properties are not considered. Grant describes certain effects produced by chlordane on the eyes, but these effects were caused by systemic poisoning. They were not local effects. Chlordane is not known to be an eye irritant.

## 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 chlordane is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 6, 1980, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00369-6).

## 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 chlordane.

• If employees' clothing has had any possibility of being contaminated with chlordane, employees should change into uncontaminated clothing before leaving the work premises.

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

• Where there is any possibility of exposure of an employee's body to chlordane, facilities for quick drenching of the body should be provided within the immediate work area for emergency use.

• Non-impervious clothing which becomes contaminated with chlordane should be removed immediately and not reworn until the chlordane is removed from the clothing.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where chlor-

dane may contact the eyes.

## SANITATION

- Skin that becomes contaminated with chlordane should be immediately washed or showered with soap or mild detergent and water to remove any chlordane.
- Workers subject to skin contact with chlordane should wash with soap or mild detergent and water any areas of the body which may have contacted chlordane at the end of each work day.
- Eating and smoking should not be permitted in areas where chlordane is handled, processed, or stored.
- Employees who handle chlordane should wash their hands thoroughly with soap or mild detergent and water before eating, smoking, or using toilet facilities.

## COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Application as an insecticide on pre-planting soil, fire ants, and harvester ants (banned by EPA in 1976)	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 chlordane 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 chlordane gets on the skin, promptly wash the contaminated skin using soap or mild detergent and water. If chlordane soaks through the clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention immediately.

### • Breathing

If a person breathes in large amounts of chlordane, 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 chlordane has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back

of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.

### • 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 chlordane is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. Collect for reclamation or absorb in vermiculite, dry sand, earth, or a similar material.

### • Waste disposal method:

Chlordane may be disposed of by absorbing it in vermiculite, dry sand, earth or a similar material and disposing in sealed containers in a secured sanitary landfill.

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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 CHLORDANE

Condition	Minimum Respiratory Protection* Required Above 0.5 mg/m <sup>3</sup>
Particulate Concentration	
5 mg/m <sup>3</sup> or less	Any chemical cartridge respirator with an organic vapor cartridge(s) and dust and mist filter(s), including pesticide respirators which meet the requirements of this class.  Any supplied-air respirator.  Any self-contained breathing apparatus.
25 mg/m <sup>3</sup> or less	A chemical cartridge respirator with a full facepiece, organic vapor cartridge(s), and dust and mist filter(s), including pesticide respirators which meet the requirements of this class.  A chin-style or front- or back-mounted pesticide gas mask.  Any supplied-air respirator with a full facepiece, helmet, or hood.  Any self-contained breathing apparatus with a full facepiece.
500 mg/m <sup>3</sup> or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.  A powered chemical cartridge respirator with an organic vapor cartridge and a high efficiency filter, including pesticide respirators which meet the requirements of this class.
Greater than 500 mg/m <sup>3**</sup> 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 and particulates, including pesticide respirators which meet the requirements of this class.  Any escape self-contained breathing apparatus.

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

\*\*Use of supplied-air suits may be necessary to prevent skin contact while providing respiratory protection from airborne concentrations of chlordane; however, this equipment should be selected, used, and maintained under the immediate supervision of trained personnel. Where supplied-air suits are used above a concentration of 500 mg/m<sup>3</sup>, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.

