Occupational Health Guideline for Chlorinated Camphene *

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: $C_{10}H_{10}Cl_8$ (average)
- Synonyms: Toxaphene
- Appearance and odor: Waxy, amber-colored solid with a mild, turpentine-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

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

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Chlorinated camphene can affect the body if it is inhaled, is swallowed, or comes in contact with the eyes or skin. It may enter the body through the skin.

- **Effects of overexposure**

Overexposure to chlorinated camphene may cause nausea, mental confusion, agitation, involuntary trembling, convulsions, and unconsciousness. Contact with chlorinated camphene solutions may cause irritation of the skin.

- **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 chlorinated camphene.

- **Recommended medical surveillance**

The following medical procedures should be made available to each employee who is exposed to chlorinated camphene 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 central nervous system and the skin should be stressed. The skin should be examined for evidence of chronic disorders.

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

- **Summary of toxicology**

Chlorinated camphene is primarily a strong stimulant to the central nervous system. Most fatal cases of poisoning have been due to accidental ingestion, resulting in convulsions, loss of consciousness, and respiratory failure. The minimal acute lethal oral dose for man is 2 to 7 g. Few cases of intoxication due to occcupational exposure have been reported. Two cases of pneumonitis in insecticide sprayers using chlorinated camphene in an emulsion containing kerosene and xylene have been reported, but the significance of this finding is questionable as it relates to the toxicity of chlorinated camphene exposure. In solution, the substance is absorbed through the skin and causes skin irritation. In man, a single dermal application of 46 grams, or daily application of 2.4 grams, is very dangerous. Animals given repeated oral doses show degenerative changes in the liver and kidneys. Chronic exposure results in the accumulation of the substance in the fatty tissues. It is metabolized in the liver and excreted in the urine, probably in a conjugated form. Laboratory testing has indicated that this substance causes cancer in laboratory animals.

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

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 414 (average)
2. Boiling point (760 mm Hg): Decomposes
3. Specific gravity (water = 1): 1.63
4. Vapor density (air = 1 at boiling point of chlorinated camphene): 14.3
5. Melting point: 70 to 95 C (158 to 203 F)
6. Vapor pressure at 20 C (68 F): 0.2 to 0.4 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.0003
8. Evaporation rate (butyl acetate = 1): Data not available

- **Reactivity**

1. Conditions contributing to instability: Heat, especially when in contact with iron.
2. Incompatibilities: Contact with strong oxidizing agents may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride and carbon monoxide) may be released in a fire involving chlorinated camphene.
4. Special precautions: Emulsifiable concentrates of chlorinated camphene in xylene may decompose with liberation of much heat if allowed to come in contact with iron or aluminum above 70 C (158 F).

- **Flammability**

1. Flash point: 135 C (275 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishant: Dry chemical, carbon dioxide

- **Warning properties**

Chlorinated camphene 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**

Sampling and analyses may be performed by collection of chlorinated camphene on a filter, followed by extraction with petroleum ether, and gas chromatographic analysis. An analytical method for chlorinated camphene 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 liquids containing chlorinated camphene and to prevent repeated or prolonged skin contact with solid chlorinated camphene.
- If employees' clothing may have become contaminated with solid chlorinated camphene, employees should change into uncontaminated clothing before leaving the work premises.
- Clothing contaminated with solid chlorinated camphene or liquids containing chlorinated camphene should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of chlorinated camphene from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the chlorinated camphene, the person performing the operation should be informed of chlorinated camphene's hazardous properties.
- Where exposure of an employee's body to liquids containing chlorinated camphene may occur, 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 solid chlorinated camphene should be removed promptly and non-impervious clothing which becomes contaminated with liquids containing chlorinated camphene should be removed immediately and such clothing should not be reworn until the chlorinated camphene is removed from the clothing.
- Employees should be provided with and required to use dust- and splash-proof safety goggles where solid

chlorinated camphene or liquids containing chlorinated camphene may contact the eyes.

SANITATION

- Skin that becomes contaminated with solid chlorinated camphene should be promptly washed or showered and skin that becomes contaminated with liquids containing chlorinated camphene should be immediately washed or showered with soap or mild detergent and water to remove any chlorinated camphene.
- Eating and smoking should not be permitted in areas where solid chlorinated camphene or liquids containing chlorinated camphene are handled, processed, or stored.
- Employees who handle solid chlorinated camphene or liquids containing chlorinated camphene 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 chlorinated camphene may occur and control methods which may be effective in each case:

Operation	Controls
Mixing and formulation of liquid, dust, powder, and granular insecticides	Personal protective equipment
Use in application of liquid, dust, powder, or granular insecticide formulations	Personal protective equipment
Manufacture and packaging of chlorinated camphene	Process enclosure; 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 chlorinated camphene gets into the eyes, wash eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

- **Skin Exposure**

If chlorinated camphene gets on the skin, promptly wash the contaminated skin using soap or mild detergent. If liquids containing chlorinated camphene get on the skin, immediately wash the skin using soap or mild detergent. If liquids containing chlorinated camphene soak through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent.

- **Breathing**

If a person breathes in large amounts of chlorinated camphene, 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 chlorinated camphene has been swallowed, get medical attention immediately. If the chlorinated camphene is dissolved in a petroleum-based material, do not make the exposed person vomit. If medical attention is not immediately available and the chlorinated camphene is a powder or in a water base, get the person to vomit by having him touch the back of the throat with his finger or by giving him large amounts (one pint or more) of warm salt water (two tablespoons of salt per pint of water). 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 chlorinated camphene is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. For small quantities, sweep onto paper or other suitable material, place in an appropriate container and burn in a safe place (such as a fume hood). Large quantities may be reclaimed; however, if this is not practical, use a procedure similar to that for small quantities.

- Waste disposal methods:

Chlorinated camphene may be disposed of:

1. By making packages of chlorinated camphene in paper or other flammable material and burning in a suitable combustion chamber.
2. By dissolving chlorinated camphene in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with afterburner and scrubber (alkali).

ADDITIONAL INFORMATION

To find additional information on chlorinated camphene, look up chlorinated camphene in the following documents:

- Medical Surveillance for Chemical Hazards
- Respiratory Protection for Chemical Hazards
- Personal Protection and Sanitation for Chemical Hazards

These documents are available through the NIOSH Division of Technical Services, 4676 Columbia Parkway, Cincinnati, Ohio 45226.

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 CHLORINATED CAMPHENE

Condition	Minimum Respiratory Protection* Required Above 0.5 mg/m³
Vapor Concentration	
5 mg/m³ or less	Any pesticide chemical cartridge respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
25 mg/m³ or less	Any pesticide chemical cartridge respirator with a full facepiece. 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.
200 mg/m³ or less	A powered air-purifying pesticide respirator. A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 200 mg/m³** 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.

*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 chlorinated camphene; 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 200 mg/m³, an auxiliary self-contained breathing apparatus operated in positive pressure mode should also be worn.