

Occupational Health Guideline for 1,3-Dichloro-5,5-Dimethylhydantoin

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: $C_6H_6Cl_2N_2O_2$
- Synonyms: Halane; dactin
- Appearance and odor: White solid with a chlorine-like odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for 1,3-dichloro-5,5-dimethylhydantoin is 0.2 milligram of 1,3-dichloro-5,5-dimethylhydantoin per cubic meter of air (mg/m^3) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

- Routes of exposure
1,3-Dichloro-5,5-dimethylhydantoin can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.
- Effects of overexposure
 1. *Short-term Exposure:* This chemical is a chlorine bleach which is activated by moisture and may irritate the eyes, nose, throat, lungs, and skin.
 2. *Long-term Exposure:* None known.
 3. *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 1,3-dichloro-5,5-dimethylhydantoin.
- Recommended medical surveillance
The following medical procedures should be made available to each employee who is exposed to 1,3-

dichloro-5,5-dimethylhydantoin at potentially hazardous levels:

1. *Initial Medical Screening:* Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from 1,3-dichloro-5,5-dimethylhydantoin exposure.

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,3-dichloro-5,5-dimethylhydantoin might cause exacerbation of symptoms due to its irritant properties.

2. *Periodic Medical Examination:* Any employee developing the above-listed conditions should be referred for further medical examination.

- Summary of toxicology
1,3-Dichloro-5,5-dimethylhydantoin powder in contact with water yields hypochlorous acid, which is an eye and mucous membrane irritant. The LD50 for rats, when administered orally as a 10% aqueous suspension, was 542 mg/kg; at necropsy, gastrointestinal hemorrhages were found. There is a single report of workmen exposed to an average concentration of 1.97 mg/m^3 experiencing marked respiratory irritation.

CHEMICAL AND PHYSICAL PROPERTIES

- Physical data
 1. Molecular weight: 197
 2. Boiling point (760 mm Hg): Not available
 3. Specific gravity (water = 1): 1.5
 4. Vapor density (air = 1 at boiling point of 1,3-dichloro-5,5-dimethylhydantoin): 6.8
 5. Melting point: 130 C (266 F)
 6. Vapor pressure at 20 C (68 F): Not available
 7. Solubility in water, g/100 g water at 20 C (68 F): 0.20
 8. Evaporation rate (butyl acetate = 1): Not applicable
- Reactivity
 1. Conditions contributing to instability: Dry 1,3-

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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dichloro-5,5-dimethylhydantoin decomposes with formation of toxic gases at 202–210 C (395–410 F). If material is wet, it will decompose at lower temperatures.

2. **Incompatibilities:** Contact with water, strong acids, and easily oxidized materials such as ammonium salts, sulfides, etc., may cause fires and explosions and formation of toxic fumes of chlorine and nitrogen trichloride.

3. **Hazardous decomposition products:** Toxic gases and vapors (such as chlorine, hydrogen chloride, phosgene, and carbon monoxide) may be released in a fire involving 1,3-dichloro-5,5-dimethylhydantoin.

4. **Special precautions:** 1,3-Dichloro-5,5-dimethylhydantoin will attack some forms of plastics, rubber, and coatings.

• **Flammability**

1. **Flash point:** 174 C (346 F)

2. **Autoignition temperature:** Not available

3. **Flammable limits in air, % by volume:** Not available

4. **Extinguishant:** Carbon dioxide, dry chemical

• **Warning properties**

1,3-Dichloro-5,5-dimethylhydantoin is a powder, but in the presence of moisture chlorine gas is released. May states that the odor threshold of chlorine is .01 ppm, which is well below the permissible exposure of 1 ppm. Chlorine has adequate warning properties.

Stecher reports that the chlorine liberated upon the decomposition of 1,3-dichloro-5,5-dimethylhydantoin may produce irritation of the eyes and mucous membranes. Patty reports that men can work without interruption in an environment containing 3 to 6 mg/m³ of chlorine, but exposures to concentrations of 10 to 20 mg/m³ causes "a stinging or burning sensation in the eyes . . ." Eye protection is recommended for any possibility of contact in the personal protection section.

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**

At the time of publication of this guideline, no measurement method for 1,3-dichloro-5,5-dimethylhydantoin had been published by NIOSH.

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 or liquids containing 1,3-dichloro-5,5-dimethylhydantoin.

• If employees' clothing may have become contaminated with solid 1,3-dichloro-5,5-dimethylhydantoin, employees should change into uncontaminated clothing before leaving the work premises.

• Clothing contaminated with solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of 1,3-dichloro-5,5-dimethylhydantoin from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,3-dichloro-5,5-dimethylhydantoin, the person performing the operation should be informed of 1,3-dichloro-5,5-dimethylhydantoin's hazardous properties.

• Non-impervious clothing which becomes contaminated with solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin should be removed promptly and not reworn until the 1,3-dichloro-5,5-dimethylhydantoin is removed from the clothing.

• Employees should be provided with and required to use dust- and splash-proof safety goggles where there is any possibility of solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin contacting the eyes.

• Where there is any possibility that employees' eyes may be exposed to solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin, an eye-wash fountain should be provided within the immediate work area for emergency use.

SANITATION

- Skin that becomes contaminated with solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin should be promptly washed or showered with soap or mild detergent and water to remove any 1,3-dichloro-5,5-dimethylhydantoin.
- Employees who handle solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin 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 1,3-dichloro-5,5-dimethylhydantoin may occur and control methods which may be effective in each case:

Operation	Controls
Use as a bactericide, sporicide, or sanitizer in swimming pools, dairies, laundries, restaurants, cutting oils, and pharmaceutical industry; as a general cleaner	General dilution ventilation; personal protective equipment
Use as a mild chlorinating agent in organic synthesis	Process enclosure; local exhaust ventilation; general dilution ventilation
Liberation during use as a rubber retarder	Process enclosure; local exhaust ventilation; general dilution ventilation
Use as a bleaching agent in commercial laundries	General dilution ventilation; personal protective equipment
Use as stabilizer, discoloration preventer, and catalyst in polymer industry; use to emboss or texturize resinous sheet preparations	Process enclosure; local exhaust ventilation; general dilution ventilation

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 1,3-dichloro-5,5-dimethylhydantoin 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 solid or liquids containing 1,3-dichloro-5,5-dimethylhydantoin get on the skin, promptly flush the contaminated skin using soap or mild detergent and water. If liquids containing 1,3-dichloro-5,5-dimethylhydantoin soak through the clothing, remove the clothing promptly and flush 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 1,3-dichloro-5,5-dimethylhydantoin, 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 1,3-dichloro-5,5-dimethylhydantoin 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 1,3-dichloro-5,5-dimethylhydantoin is spilled, the following steps should be taken:

1. Remove all ignition sources.
2. Ventilate area of spill.
3. 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.) Small quantities may also be slowly added to large amounts of water and flushed into a sewer. Large quantities may be reclaimed; however, if this is not practical, dissolve in a flammable solvent (such as alcohol) and atomize in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

- Waste disposal methods:

1,3-Dichloro-5,5-dimethylhydantoin may be disposed of:

1. By making packages of 1,3-dichloro-5,5-dimethylhydantoin in paper or other flammable material and burning in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

2. By dissolving 1,3-dichloro-5,5-dimethylhydantoin in a flammable solvent (such as alcohol) and atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

3. Small quantities may be slowly added to large amounts of water and flushed into a sewer.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "1,3-Dichloro-5,5-Dimethylhydantoin," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

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RESPIRATORY PROTECTION FOR 1,3-DICHLORO-5,5-DIMETHYLHYDANTOIN

Condition	Minimum Respiratory Protection* Required Above 0.2 mg/m ³
Particulate Concentration	
5 mg/m ³ or less	Any chemical cartridge respirator with a full facepiece, chlorine cartridge(s), and dust filter(s). A gas mask with a chin-style or a front- or back-mounted chlorine canister and dust filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 5 mg/m ³ 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 chlorine and particulates. Any escape self-contained breathing apparatus.

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