

Occupational Health Guideline for Glycidol

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: $C_2H_4O_2$
- Synonyms: 2-Hydroxymethyloxiran; hydroxymethyl ethylene oxide; epoxypropyl alcohol; glycide; 3-hydroxypropylene oxide; 2,3-epoxy-1-propanol
- Appearance: Colorless liquid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for glycidol is 50 parts of glycidol per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 150 milligrams of glycidol per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- **Routes of exposure**
Glycidol can affect the body if it is inhaled, is swallowed, or comes in contact with the eyes or skin.
- **Effects of overexposure**
 1. **Short-term Exposure:** Overexposure to glycidol may cause irritation of the eyes, nose, and throat.
 2. **Long-term Exposure:** Prolonged overexposure might produce irritation of the skin.
 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 glycidol.
- **Recommended medical surveillance**
The following medical procedures should be made available to each employee who is exposed to glycidol 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 glycidol exposure.

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

—Chronic respiratory disease: In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of glycidol 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**

Glycidol vapor is an irritant to the eyes and upper respiratory tract, a skin irritant, and a central nervous system depressant. The LC50 for mice (4 hr) was 450 ppm, and for rats (8 hr), 580 ppm, resulting in pneumonitis; rats exposed at 400 ppm daily showed only slight eye irritation and mild respiratory distress, with no evidence of systemic toxicity. Lethal doses of 0.45 to 0.85 g/kg of the liquid administered by gastric tube resulted initially in nervous system depression, but surviving animals showed a reversal of the depressant effect, manifested by excitation and tremors. Direct application of the liquid to the skin of animals classifies glycidol as a moderate skin irritant; instilled into the eye, it is classified as a severe eye irritant. Exposure to near-saturated vapor for 8 hours resulted in corneal opacity. Repeated intramuscular injections do not affect hematopoiesis in rats. The only report of toxic effects in humans is that of irritation of the eyes, nose, and respiratory tract of experimenters working with the compound at room temperature.

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

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 74
2. Boiling point (760 mm Hg): 166 C (331 F) (decomposes)
3. Specific gravity (water = 1): 1.1
4. Vapor density (air = 1 at boiling point of glycidol): 2.6
5. Melting point: -45 C (-49 F)
6. Vapor pressure at 20 C (68 F): 0.9 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Miscible in all proportions

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

• Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents (especially nitrates) may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving glycidol.
4. Special precautions: Glycidol will attack some forms of plastics, rubber, and coatings.

• Flammability

1. Flash point: 72 C (162 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, alcohol foam

• Warning properties

1. Odor Threshold: No information is available concerning the odor threshold of glycidol.
2. Eye Irritation Level: Grant states, "In vapor form, glycidol has proven damaging to the corneas of rats, but for human beings the vapor has been found to have adequate warning properties, consisting of eye and respiratory irritation, to preclude excessive industrial exposure." The *Documentation of TLV's* states that following the first few exposures, "rats exposed at 400 ppm glycidol 7 hours a day for 50 days . . . (experienced) very slight irritation of the eyes, with slight lacrimation and encrustation of the eyelids . . ." No quantitative information is available concerning the threshold of eye irritation.
3. Evaluation of Warning Properties: Since no quantitative information is available relating warning properties to air concentrations of glycidol, this substance is treated as a material with poor 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 glycidol vapors using an adsorption tube with subsequent desorption with tetrahydrofuran and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure glycidol may be used. An analytical method for glycidol 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 liquid glycidol.
- Clothing contaminated with liquid glycidol should be placed in closed containers for storage until it can be discarded or until provision is made for the removal of glycidol from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the glycidol, the person performing the operation should be informed of glycidol's hazardous properties.
- Non-impervious clothing which becomes contaminated with liquid glycidol should be removed promptly and not reworn until the glycidol is removed from the clothing.

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

SANITATION

- Skin that becomes contaminated with liquid glycidol should be promptly washed or showered to remove any glycidol.
- Employees who handle liquid glycidol should wash their hands thoroughly before eating, smoking, or using toilet facilities.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in surface coatings; use in chemical synthesis; use as a stabilizer for natural oils and vinyl polymers	General dilution ventilation; personal protective equipment
Use as a demulsifying agent; use as a dye leveling (retarding) agent	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 glycidol 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 glycidol gets on the skin, promptly wash the contaminated skin with water. If glycidol soaks through the clothing, remove the clothing immediately and wash the skin with water. If irritation persists after washing, get medical attention.

• Breathing

If a person breathes in large amounts of glycidol, 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 glycidol 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 glycidol 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, or absorbed in vermiculite, dry sand, earth, or a similar material and disposed in a sanitary landfill.

• Waste disposal method:

Glycidol may be disposed of by dissolving in petroleum and atomizing in a suitable combustion chamber, or absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a sanitary landfill.

REFERENCES

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RESPIRATORY PROTECTION FOR GLYCIDOL

Condition	Minimum Respiratory Protection* Required Above 50 ppm
Vapor Concentration	
500 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 500 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.