

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** PHENYL GLYCIDYL ETHER ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for PHENYL GLYCIDYL ETHER

The basic text of this document contains the draft technical standard approved by the Joint Review Committee of the NIOSH/OSHA Standards Completion Program and the supporting documentation for the substance PHENYL GLYCIDYL ETHER.

The SCP draft technical standards are recommendations to the Department of Labor for its consideration in rulemaking and have no legal status until final rules have been promulgated by that agency. This draft standard is provided for your information only.

The References and Sources, Respirator Table Documentation and Use/Exposure and Control Documentation are the working documents used by the various SCP working groups during the development of the draft technical standard and serve as the technical foundation for the standard. The classification for each substance and the regulatory statements were derived following a decision logic established for the various sections of the standard.

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of phenyl glycidyl ether in concentrations not in excess of 10 parts per million (ppm) (60 milligrams per cubic meter, mg/cu.m.) averaged over an eight hour work shift, as stated in section 1910.93, Table G-1.
- (2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for phenyl glycidyl ether.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which phenyl glycidyl ether is present shall:

- (1) STANDARD AVAILABILITY - Keep a copy of this section with its appendices A, B and C, at the workplace. This material shall be made readily available to affected employees; and
- (2) PRESENCE OF PHENYL GLYCIDYL ETHER - Inform affected employees of the quantity, location, and manner of use or storage of phenyl glycidyl ether.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which phenyl glycidyl ether is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of phenyl glycidyl ether at or above the action level. The determination shall be made each time there is a change in production, process, or control measures which could result in an increase in airborne concentrations of phenyl glycidyl ether. A written determination shall be made and it shall contain at least the following information:
 - (i) Any information, observations, or calculations which would indicate employee exposure to phenyl glycidyl ether;
 - (ii) Any measurements of airborne concentrations of phenyl glycidyl ether taken;
 - (iii) Any employee complaints of symptoms which may be attributable to exposure to phenyl glycidyl ether; and
 - (iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.
- (2) INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of phenyl glycidyl ether at or above the action level, the exposure of the employee believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum exposure of the employee.
- (3) IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of phenyl glycidyl ether at or above the action level, the employer shall:
 - (i) Identify all employees who may be exposed at or above the action level; and
 - (ii) Measure the exposure of the employees so identified.
- (4) EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of phenyl glycidyl ether at or above the action

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level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

- (5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of phenyl glycidyl ether above the permissible exposure, the employer shall:
- (i) Inform the employee of the exposure as required by paragraph (N)(1) of this section; and
 - (ii) Measure the exposure of the employee at least monthly; and
 - (iii) Institute control measures as required by paragraph (E) of this section.
- (6) TERMINATION OF EXPOSURE MEASUREMENT - If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to airborne concentrations of phenyl glycidyl ether below the action level, the employer may terminate measurement for the employee. For purposes of this subparagraph, use of respirators shall not constitute reduction of employee exposure below the action level.
- (d) METHODS OF MEASUREMENT - An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight hour work shift (Appendix B (iv)). The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1 below.

Table 1

Concentration	Required Accuracy
Above permissible exposure	Plus or Minus 25%
At or below permissible exposure and above the action level	Plus or Minus 35%
At or below the action level	Plus or Minus 50%

- (e) Methods of Compliance
- (1) Engineering controls - No employee shall be exposed to phenyl glycidyl ether above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to phenyl glycidyl ether to at or below the permissible exposure.
- (i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (for example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process or control which might result in a reduction in control.
- (2) Respirators
- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:
 - (a) During the time period necessary to install engineering controls; or
 - (b) In work situations in which engineering controls are technically not feasible; or
 - (c) In work situations in which feasible engineering and work practice controls are insufficient to reduce employees exposure to at or below permissible exposure,

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- they shall be used to reduce exposure to the lowest level feasible; or
- (d) For operations not exceeding 40 hours per year; or
 - (e) In emergencies.
 - (ii) Respirators shall be jointly approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.
 - (iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.
 - (iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b), (d), (e) and (f).

TABLE 2. RESPIRATORY PROTECTION FOR PHENYL GLYCIDYL ETHER

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 100 ppm	and organic vapor cartridge(s) with dust, fume, and mist fil A gas mask with a chin-style or front or back mounted organi vapor canister with dust, fume, and mist filter. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece
Greater than 100 ppm or Entry & Escape from Unknown Concentrations	demand or other positive pressure mode or continuous flow mo an auxiliary self-contained air supply 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.

-(f) Fire and Safety

Employers shall familiarize themselves with the information contained in the Substance Technical Guidelines for phenyl glycidyl ether which is contained in Appendix B in order to ensure the safe handling and use of phenyl glycidyl ether. (1) Electrical - For the purposes of compliance with section 1910.309,

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locations classified as hazardous locations due to the presence of phenyl glycidyl ether shall be class I Group C.

- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, phenyl glycidyl ether is classified as a Class B fire hazard.
 - (3) Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of phenyl glycidyl ether shall be class I Group C.
 - (4) Combustible liquids - For the purposes of compliance with section 1910.106, liquid phenyl glycidyl ether is classified as a Class IIIB combustible liquid.
 - (5) Sources of ignition - Sources of ignition such as smoking or open flames are prohibited where phenyl glycidyl ether is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
 - (6) Storage - Phenyl glycidyl ether shall be stored so as not to come in contact with strong oxidizers, amines, strong acids and strong bases.
- (g) Personal Protective Equipment
- (1) Skin Contact
 - (i) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8-inch minimum) and other appropriate protective clothing necessary to prevent any possibility of skin contact to liquid phenyl glycidyl ether. Face shields shall comply with section 1910.133 (a)(6).
 - (ii) Employers shall ensure that clothing contaminated with liquid phenyl glycidyl ether is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of phenyl glycidyl ether from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the phenyl glycidyl ether, the employer shall inform the person performing the operation of the hazardous properties of phenyl glycidyl ether.
 - (iii) Employers shall ensure that non-impervious clothing contaminated with liquid phenyl glycidyl ether be removed promptly and not reworn until the phenyl glycidyl ether is removed from the clothing.
 - (2) Eye Contact
 - (i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133 (a)(6), where eye contact to liquid phenyl glycidyl ether may occur.
- (h) Spills
- (1) Spills of phenyl glycidyl ether shall be cleaned up immediately after utilizing available ventilation.
- (i) Sanitation
- (1) Employers shall ensure that employees whose skin becomes contaminated with liquid phenyl glycidyl ether promptly wash or shower using soap or mild detergent to remove any phenyl glycidyl ether from the skin.

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- (2) Employers shall ensure that employees who handle liquid phenyl glycidyl ether wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- (j) Training and Information - Each employer who has employees exposed to phenyl glycidyl ether in excess of the action level, or employees who may have skin or eye contact with liquid phenyl glycidyl ether, or employees who work where accidental release, spill, fire, or explosion of phenyl glycidyl ether may occur, shall annually:
 - (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for phenyl glycidyl ether, which is contained in Appendix A; and
 - (2) Medical -
 - (I) Advise employees as to the signs and symptoms of exposure to phenyl glycidyl ether.
 - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to phenyl glycidyl ether which are listed in Appendix A.
 - (III) Instruct the employees to inform the employer if they develop any of the medical conditions listed in (k)(2) of this section; and
 - (3) Procedures -
 - (I) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to phenyl glycidyl ether.
 - (II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours.
- (k) Medical Surveillance
 - (1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.
 - (2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid phenyl glycidyl ether, or airborne concentrations of phenyl glycidyl ether at or above the action level, a written statement as to whether such employee has a history of any of the following:
 - (I) Skin disease
 - (II) Kidney disease
 - (III) Chronic lung disease
 - (IV) Liver disease
 - (3) Preplacement Medical Examination - The employer shall provide a medical examination for an employee if the employee provides a history of any of the conditions named in paragraph (k)(2).
 - (4) Results of Preplacement Examination - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).
 - (5) Periodic Medical Examinations - The employer shall provide a medical examination for an employee if the employee advises the employer of the development of:
 - (I) Any of the medical conditions listed in (k)(2).

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- (II) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to phenyl glycidyl ether.
- (6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).
- (7) Exclusion or Removal from Exposure - No employee shall continue to be exposed to phenyl glycidyl ether if such exposure could place the employee at increased risk of material impairment of his health.
- (8) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to phenyl glycidyl ether.
- (9) Informing the Physician - The employer shall provide to the examining physician the following information:
 - (I) A copy of this section with its Appendices A, B, and C;
 - (II) A description of the employee's duties as they relate to his exposure to phenyl glycidyl ether;
 - (III) A description of any personal protective equipment, including respirators, required to be used;
 - (IV) The results of any employee's exposure measurement, if available;
 - (V) The employee's anticipated exposure level; and
 - (VI) Upon request of the physician, information from previous medical examination of the employee.
- (10) Physician's Written Opinion
 - (I) The physician's written opinion shall be a signed statement by the examining physician specifically stating:
 - (A) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to phenyl glycidyl ether or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.
 - (B) Any recommended limitations upon the employee's exposure to phenyl glycidyl ether.
 - (C) The employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.
 - (II) The written opinion shall not reveal medical information unrelated to exposure to phenyl glycidyl ether.
- (11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.
- (1) Recordkeeping.
- (1) Initial determination.

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- (i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.
 - (ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.
 - (iii) This record shall be maintained until replaced by a more recent record.
- (2) Exposure measurements.
- (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to phenyl glycidyl ether.
 - (ii) This record shall include:
 - (a) The date of measurement;
 - (b) A reference to the subparagraph of this regulation which required the measurement, if any;
 - (c) Operations involving exposure to phenyl glycidyl ether which are being monitored;
 - (d) Sampling and analytical methods used and evidence of their accuracy;
 - (e) Number, duration, and results of samples taken;
 - (f) Name, Social Security number, and exposure of the employee monitored.
 - (iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.
- (3) Mechanical ventilation.
- (i) When mechanical ventilation is used as an engineering control, the employer shall maintain a record of measurements demonstrating the effectiveness of such ventilation as required by paragraph (e)(1)(i) of this section.
 - (ii) This record shall include:
 - (a) Date of measurement;
 - (b) Type of measurement taken;
 - (c) Result of measurement.
 - (iii) This record shall be maintained for at least one year.
- (4) Training and information.
- (i) The employer shall keep an accurate record of all employee training and advice required by paragraph (j) of this section.
 - (ii) The record shall include:
 - (a) Date of training;
 - (b) Name and Social Security number of employees trained;
 - (c) Substance of training provided.
 - (iii) This record shall be maintained until replaced by a more recent record.
- (5) Medical records.
- (i) The employer shall keep an accurate medical record for each employee.
 - (ii) The record shall include:
 - (a) Physician's written opinion;
 - (b) Preplacement questionnaire;
 - (c) Any employee medical complaints relative to exposure to phen

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- (d) A signed statement of any refusal to be examined;
- (e) A copy of information provided to the physician pursuant to paragraph (k)(9)(ii) through (vi) of this section.
- (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records.
 - (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.
 - (ii) Employee exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
 - (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (m) Observation of monitoring.
 - (1) Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to phenyl glycidyl ether which is conducted pursuant to this section.
 - (2) Exercise of opportunity to observe monitoring.
 - (i) When observation of the monitoring of employee exposure to phenyl glycidyl ether requires entry into an area where the use of personal protective devices is required, the observer shall use such equipment and comply with all other applicable safety procedures.
 - (ii) Without interfering with the measurement, observers shall be entitled to:
 - (a) Receive an explanation of the measurement procedures;
 - (b) Visually observe all steps related to the measurement of exposure to phenyl glycidyl ether that are being performed at the place of exposure.
 - (c) Record the results obtained.
- (n) Employee notification.
 - (1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to phenyl glycidyl ether above the permissible exposure. The employee shall also be notified of the level of his exposure and the corrective action being taken to reduce the exposure to at or below the permissible exposure.
 - (2) Pursuant to paragraph (k) of this Section, when an employee is medically examined the employer shall provide the employee with a copy of the physician's written opinion.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Phenyl glycidyl ether (PGE)

PERMISSIBLE EXPOSURE: 10 parts of phenyl glycidyl ether per million parts of air (ppm) or 60 milligrams of phenyl glycidyl ether per cubic meter of air (mg/cu m)

APPEARANCE: Colorless liquid

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Phenyl glycidyl ether can affect your body if you inhale it, swallow it, or if it comes in contact with your eyes or skin.

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to phenyl glycidyl ether may cause irritation of the eyes, nose, and throat.
2. Long-Term Overexposure: Prolonged or repeated exposure may cause skin irritation or sensitization.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with phenyl glycidyl ether exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If phenyl glycidyl ether gets into your eyes, wash the 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.

B. Skin Exposure: If phenyl glycidyl ether gets on your skin, promptly wash the contaminated skin using soap or mild detergent. If phenyl glycidyl ether soaks through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent. If irritation persists, get medical attention. Do not wear the clothing again until the phenyl glycidyl ether has been removed. Replace or repair impervious clothing that has developed leaks.

C. Breathing: If you or any other person breathes in large amounts of phenyl glycidyl ether remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration.

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Keep the affected person warm and at rest. Get medical attention as soon as possible.

- D. Swallowing: When phenyl glycidyl ether has been swallowed get medical attention immediately. If medical attention is not immediately available get the affected 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.
- E. Rescue: Move 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 yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. RESPIRATORS: Respirators are not the best way to control exposure to phenyl glycidyl ether. You can only be required to wear them for routine use if your employer is in the process of installing controls or other control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you experience irritation from phenyl glycidyl ether while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent any possibility of skin contact with liquid phenyl glycidyl ether.
- C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid phenyl glycidyl ether may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Phenyl glycidyl ether is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures. It must be stored in tightly closed containers in a well-ventilated area away from heat,

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sparks, flames, strong oxidizers, amines, strong acids and strong bases. Sources of ignition such as smoking and open flames are prohibited wherever phenyl glycidyl ether is handled, used or stored in a manner that could create a potential fire or explosion hazard. If your skin becomes contaminated with liquid phenyl glycidyl ether, you must promptly wash or shower using soap or mild detergent to remove any phenyl glycidyl ether from the skin. You must promptly remove any non-impervious clothing that becomes contaminated with liquid phenyl glycidyl ether and this clothing must not be reworn until the phenyl glycidyl ether is removed from the clothing. If you handle liquid phenyl glycidyl ether, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where phenyl glycidyl ether is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
PHENYL GLYCIDYL ETHER

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: Glycidyl phenyl ether; phenyl epoxypropyl ether; 1,2-epoxy-3-phenoxypropane; PGE
 2. Formula: C6H5OCH2CHOCH2
 3. Molecular weight: 150
- B. Physical Data
1. Boiling point (760 mm Hg): 245 C (473 F)
 2. Specific gravity (water=1): 1.1
 3. Vapor density (air=1 at boiling point of phenyl glycidyl ether): 5.2
 4. Melting point: 3.5 C (38 F)
 5. Vapor pressure at 20 C (68 F): 0.01 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): Very low
 7. Evaporation rate (butyl acetate=1): Data not available
 8. Appearance: Colorless liquid
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Flash point: 120 C (248 F) (closed cup)
 2. Autoignition temperature: Data not available
 3. Flammable limits in air, % by volume: Data not available
 4. Extinguishing media: Dry chemical, carbon dioxide, foam
 5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
 6. Unusual fire and explosion hazards: Phenyl glycidyl ether is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where phenyl glycidyl ether is used, handled or stored in a manner so as to create a potential fire or explosion hazard.
 7. For purposes of complying with the requirements of 29 CFR 1910.106, phenyl glycidyl ether is classified as a Class IIIB combustible liquid.
 8. For purposes of complying with the requirements of 29 CFR 1910.309, the classification of hazardous locations as defined in Article 500 of the National Electrical Code shall be Class I, Group C.
- B. Reactivity
1. Conditions contributing to instability: Heat, contact with acids and bases

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2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Amines, strong acids and strong bases may cause polymerization with liberation of heat and spattering.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving phenyl glycidyl ether.
4. Special precautions: Phenyl glycidyl ether will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. If phenyl glycidyl ether 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. Remove to a safe place (such as a fume hood). Large quantities may be collected and atomized in a suitable combustion chamber, or absorbed on vermiculite, dry sand, earth or similar material and disposed of in a sanitary landfill.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods:

Phenyl glycidyl ether may be disposed of by dissolving in petroleum ether and atomizing in a suitable combustion chamber or by absorbing in vermiculite, dry sand, earth or similar material and depositing in a sanitary landfill.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses or dosimeters. The method of measurement must determine the concentration of phenyl glycidyl ether to plus or minus 35%.
- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of phenyl glycidyl ether to plus or

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minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store phenyl glycidyl ether in tightly closed containers in a well-ventilated area away from heat.
- B. Employers must advise employees of all plant areas and operations where exposure to phenyl glycidyl ether could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to phenyl glycidyl ether is likely to occur are: during its production and the production of epoxy polymers; its use as a stabilizer for commercial chlorinated compounds such as chlorinated paraffin, chlorinated rubber, pesticides, etc; as a curing compound of polymers and resins; and as a chemical intermediate in the synthesis of certain special glycerols and polyglycerols.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Phenyl glycidyl ether is primarily an irritant to the eye, the respiratory tract, and the skin. Rats exposed for 7 hours a day over 50 days at 100 ppm, the highest vapor concentration obtainable, showed no overt signs of toxicity and no deaths, although a few animals when sacrificed had mild pulmonary inflammation and nonspecific cellular changes in the liver. Only minimal signs of eye irritation and respiratory distress were noted. Intragastric LD50 values were 1.40 and 3.85 g/kg respectively for mice and rats. The predominant effect was central nervous system depression. Surviving animals exhibited a reversal of the depressant effect, with increased central nervous system activity manifested by hypersensitivity to sound, muscle twitching and tremors. Rats given 3 daily injections of 400 mg/kg showed no signs of bone marrow depression. Use experience, primarily in laboratories, indicates that the main hazard is skin irritation and sensitization from contact with the liquid and eye irritation. No chronic systemic effects have been reported in humans.

III. SIGNS AND SYMPTOMS

Skin irritation and sensitization; may cause irritation of the eyes and upper respiratory tract; narcosis may occur at sustained high levels.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes and skin with water. If swallowed and the person is conscious, induce vomiting. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of phenyl glycidyl ether are caused by its irritant properties and skin sensitization. It is important that the physician becomes familiar with plant operating conditions in which exposure to phenyl glycidyl ether occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

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B. PREPLACEMENT

Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from phenyl glycidyl ether exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- Phenyl glycidyl ether can cause dermatitis. Persons with pre-existing skin disorders may be more susceptible to the effects of this agent.
2. Liver disease -- Although phenyl glycidyl ether is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.
3. Kidney disease -- Although phenyl glycidyl ether is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
4. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of phenyl glycidyl ether might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

Routine periodic examinations are not required. However, if the employer becomes aware of an employee with the above listed conditions, he must refer such employee for further medical examination.

References

1. American Conference of Governmental Industrial Hygienists: "Phenyl Glycidyl Ether," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 206-207.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1639-1641.
3. Hine, C.H., et al.: "Toxicology of Glycidol and Some Glycidyl Ethers," A.M.A. Archives of Industrial Health, 14:250-264, 1956.
4. Kodama, J.K., et al.: "Some Effects of Epoxy Compounds on the Blood," Archives of Environmental Health, 2:50-61, 1961.

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REFERENCES AND SOURCES
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1910.93

- (e) Fire and Safety
(1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al., National Academy of Sciences, 1973, report to U. S. Coast Guard, report no. CG-D-92-74, p. 31.
- (f) Personal Protection and, (h) Sanitation
Eye: Documentation in Support of TLV; Patty, "Ind. Hyg. and Tox.;" Shell MSDS; Grant, "Toxicology of the Eye"
Skin: Documentation in Support of TLV; Patty, "Ind. Hyg. and Tox.;" Sax, "Dangerous Properties of Ind. Materials;" Shell MSDS; Hine, C. H., Kodama, J. K., Wellington, J. S., Dunlap, M. K., and Anderson, H. H., "The Toxicology of Glycidol and Some Glycidyl Ethers," AMA Arch. of Ind. Health, Sept. 1956
Ingestion: Documentation in Support of TLV; Sax, "Dangerous Properties of Ind. Materials;" Shell MSDS

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Documentation of TLV's states that it is mildly irritating to the eye. Patty agrees. Shell MSDS considers it to be moderately irritating to the eyes. Grant states that phenyl glycidyl ether has been tested by application to rabbit eyes and caused slight reversible corneal damage.

A classification of 2 is clearly appropriate.

Skin - Classification: 1

Output statement numbers: 1, 7a, 17g, 17i, 20a

Exceptions: See below

Documentation of TLV's states that "PGE is practically nontoxic on percutaneous absorption . . . and use experience indicates moderate skin irritation on prolonged or repeated contact, and several cases of skin sensitization." Sax considers it to be an acute local irritant of moderate toxic hazard and lists it as being of moderate toxic hazard by acute systemic skin absorption. It is also listed as being a chronic local allergen of slight toxic hazard. Patty gives a rabbit skin penetration of LD50 of 2.99 g/kg but agrees that it is practically nontoxic by skin absorption. Patty also notes that the material is only mildly irritating on single application but repeated applications give rise to erythema and edema. Several cases of sensitization are again noted. Dermatitis has been noted in persons repeatedly exposed. Shell MSDS considers it to be a strong sensitizer. Protective clothing is highly recommended. Based on case histories given in Hine et al., which appears to be the source documents for most comments made above, it is concluded that it is a strong sensitizer. Other sources, noted in the comments for other monoepoxides,

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have noted that these materials do not cause radimimetic effects.

The vapor pressure of phenyl glycidyl ether is 0.01 mm Hg at 20 degrees C. Its melting point is 38 degrees F, its solubility in water is "very low," and its flash point is 248 deg

The substance is assigned a classification of 1 because it is a potent sensitizer. However, statement 7a is substituted for 6 because 6 is not justified for sensitizers. While this substance is a skin sensitizer, its effects are not considered to be rapidly occurring enough to justify deluge showers (statement 8). For the same reason, statements 14g and 14i are replaced by 17g and 17i; thus requiring only "prompt" action rather than "immediate" action.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Documentation of TLV's gives an oral LD50 of 4.26 g/kg.

Sax lists the acute systemic effects of ingestion to be of slight toxic hazard. Shell MSDS gives an oral rat LD50 of 3.85 g/kg.

The moderate acute toxicity of the substance, and the fact that all contact with it must be prevented, leads to the conclusion that ingestion of harmful quantities would not present a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES
PHENYL GLYCIDYL ETHER

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Glycidyl phenyl ether; phenyl epoxypropyl ether; 1,2-epoxy-3-phenoxypropane; PGE
2. Formula: C6H5OCH2CHOCH2
3. Molecular weight: 150

B. Physical Data

1. Boiling point (760 mm Hg): 245 C (473 F)
2. Specific gravity (water=1): 1.1
3. Vapor density (air=1 at boiling point of phenyl glycidyl ether): 5.2
4. Melting point: 3.5 C (38 F)
5. Vapor pressure at 20 C (68 F): 0.01 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Very low
7. Evaporation rate (butyl acetate=1): Data not available
8. Appearance: Colorless liquid

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 120 C (248 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishing media: Dry chemical, carbon dioxide, foam
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.

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6. Unusual fire and explosion hazards: Phenyl glycidyl ether is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where phenyl glycidyl ether is used, handled or stored in a manner that could create a potential fire or explosion hazard.
7. For purposes of complying with the requirements of 29 CFR 1910.106, phenyl glycidyl ether is classified as a Class IIIB combustible liquid.
8. For purposes of complying with the requirements of 29 CFR 1910.309, the classification of hazardous locations as defined in Article 500 of the National Electrical Code shall be Class I, Group C.

B. Reactivity

1. Conditions contributing to instability: Heat, contact with acids and bases.
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Amines, strong acids and strong bases may cause polymerization with liberation of heat and spattering.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide) may be released in a fire involving phenyl glycidyl ether.
4. Special precautions: Phenyl glycidyl ether will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. If phenyl glycidyl ether 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. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Phenyl glycidyl ether may be disposed of:
 1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
 2. By atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Short term interval samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the 8-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of

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an employee's average level of exposure for that work shift. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, gas and vapor adsorption tubes with subsequent chemical analyses or dosimeters. The method of measurement must determine the concentration of phenyl glycidyl ether to plus or minus 35%.

- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of phenyl glycidyl ether to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store phenyl glycidyl ether in tightly closed containers in a well-ventilated area away from heat.
- B. Employers should advise employees of all plant areas and operations where exposure to phenyl glycidyl ether could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to phenyl glycidyl ether is likely to occur are: during its production and the production of epoxy polymers; its use as a stabilizer for commercial chlorinated compounds such as chlorinated paraffin, chlorinated rubber, pesticides, etc; as a curing compound of polymers and resins; and as a chemical intermediate in the synthesis of certain special glycerols and polyglycerols.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Phenyl glycidyl ether (PGE)

D. O. L. STANDARD: 10 ppm

WARNING PROPERTIES:

Odor Threshold: There is no quantitative information concerning the odor threshold of PGE.

Eye Irritation Level: According to Grant, the glycidyl ethers "are very irritating to the eyes. . ." The Documentation of TLV's states that PGE is mildly irritating to the eye. There is no quantitative information, however, concerning the threshold of eye irritation. For the purposes of this standard, only full facepiece respirators are permitted.

Other Information: The Documentation of TLV's states that "the TLV of 10 ppm is believed sufficiently low to prevent depression of the central nervous system, or serious irritation of eyes and respiratory passages."

Evaluation of Warning Properties: There is no quantitative information available relating warning properties to air concentrations of PGE. Patty, in fact, states that PGE has no warning properties. For the purposes of this standard, therefore, gas sorbent respiratory equipment is not permitted.

IDLH: The IDLH is unknown, but for the purposes of this standard, 500 ppm (protection factor = 50) has been chosen as the concentration above which only the most highly reliable, positive pressure devices

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are permitted. The Documentation of TLV's states that rats exposed to 100 ppm PGE 7 hours/day for 50 days exhibited no immediately obvious signs of toxicity, and no deaths occurred. Because of the high boiling point and low vapor pressure of PGE, high concentrations of PGE are not likely to be encountered in the industrial environment.

Other Toxicological Information: The Documentation of TLV's states that "a group of 10 rats exposed at 100 ppm PGE seven hours a day for 50 days, showed mean weekly weight gains which did not differ from those of the control animals. Tissues were grossly and microscopically normal in most cases, but two rats showed peribronchial and perivascular pulmonary inflammatory cell infiltration and 'cloudy swelling' in the liver. Only minimal signs of eye irritation and respiratory distress were noted. Intragastric LD50 values were 1.40 and 3.85 g/kg respectively for mice and rats, while percutaneous LD50 for rabbits was 2.99 g/kg. Predominant toxicologic activity was depression of the central nervous system after intragastric administration. Death results from paralysis of the respiratory muscles. Animals which survived exhibited a reversal of the depressant effect with increased degree of activity of the central nervous system. Smyth et al reported a single dose oral LD50 for PGE of 4.26 g/kg. Eight-hour exposures to near-saturated vapor produced no deaths.

"PGE is practically nontoxic on percutaneous absorption, mildly i to the eye, and use experience indicates moderate skin irritation on pro or repeated contact, and several cases of skin sensitization."

According to Patty, "no systemic effects have been reported" for PGE. Patty states that this substance is only "slightly toxic following ingestion, practically nontoxic after percutaneous absorption."

LFL: Data not available

VAPOR PRESSURE AT 20 C: 0.01 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 13 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
PHENYL GLYCIDYL ETHER

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor during use as a curing compound of polymers and resins - coupling agent, catalyst or reactive diluent (rubber, thermostable epoxy resins, tire cord, electric insulating materials)	A	Local exhaust ventilation; general dilution ventilation; enclosed process - depending on procedures
2. Inhalation of vapor and skin contact with liquid during use as a stabilizer of halogenated compounds - to protect against corrosion, discoloration and decomposition (chlorinated paraffin, chlorinated rubber, chlorine containing insecticides, amine eutectics, middle petroleum distillates)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
3. Inhalation of vapor during use as a copolymer in the production of epoxy polymers with chemical resistivity and thermal stability (laminates for printed circuit boards in electronic and aerospace industries)	A	Local exhaust ventilation; general dilution ventilation; enclosed process - depending on procedure
4. Inhalation of vapor and skin contact with liquid during use as a chemical intermediate (many possibilities because of reactive epoxide group)	A,B	Local exhaust ventilation; general dilution ventilation; enclosed process - depending on process, personal protective equipment (gloves, goggles)
5. Inhalation of vapor and skin contact with liquid during synthesis of phenyl glycidyl ether	A,B	Local exhaust ventilation; general dilution ventilation; enclosed process, personal protective equipment (gloves, goggles)
6. Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage drums or during cleanup of accidental spills	A,B	Local exhaust ventilation; general dilution ventilation; personal protection devices (respirator, glove goggles)
7. Inhalation of vapor and skin contact with liquid during treatment of fabrics to impart them with crease	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)

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and abrasion resistance

- A -- Inhalation
- B -- Skin contact resulting in
localized irritation
- C -- Ingestion
- D -- Skin contact resulting in
absorption and subsequent
systemic poisoning

----- JES2 JOB STATISTICS -----

1,239 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME