

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* ISOPROPYL GLYCIDYL ETHER \*\*\*

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

basic text of this document contains the draft technical standard  
ved by the Joint Review Committee of the NIOSH/OSHA Standards  
ation Program and the supporting documentation for the substance  
OPYL GLYCIDYL ETHER.

SCP draft technical standards are recommendations to the Department of  
for its consideration in rulemaking and have no legal status until  
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led for your information only.

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

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DEFINITIONS

PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of isopropyl glycidyl ether in concentrations not in excess of 50 parts per million (ppm) (240 milligrams per cubic meter, mg/cu.m.) averaged over an eight hour work shift, as stated in section 1910.93, Table G-1.

ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for isopropyl glycidyl ether.

EMPLOYEE INFORMATION - Each employer who has a workplace in which isopropyl glycidyl ether is present shall:

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

PRESENCE OF ISOPROPYL GLYCIDYL ETHER - Inform affected employees of the quantity, location, and manner of use or storage of isopropyl glycidyl ether.

EXPOSURE MEASUREMENT

INITIAL DETERMINATION - Each employer who has a place of employment in which isopropyl glycidyl ether is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of isopropyl 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 isopropyl 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 isopropyl glycidyl ether;
- (ii) Any measurements of airborne concentrations of isopropyl glycidyl ether taken;
- (iii) Any employee complaints of symptoms which may be attributable to exposure to isopropyl 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.

INITIAL EXPOSURE MEASUREMENT - If the employer determines that any employee may be exposed to airborne concentrations of isopropyl 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.

IDENTIFICATION OF EXPOSED EMPLOYEES - If the exposure measurement taken under paragraph (c)(2) of this section reveals employee exposure to airborne concentrations of isopropyl 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.

EXPOSURE ABOVE THE ACTION LEVEL - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of isopropyl 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.

EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of isopropyl 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.

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 isopropyl 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.

METHODS OF MEASUREMENT - An employee's exposure shall be obtained by 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 confidence level of 95%, of not less than that given in Table 1 below.

Table 1

| Concentration              | Required Accuracy |
|----------------------------|-------------------|
| permissible exposure       | Plus or Minus 25% |
| below permissible exposure |                   |
| above the action level     | Plus or Minus 35% |
| below the action level     | Plus or Minus 50% |

Methods of Compliance

Engineering controls - No employee shall be exposed to isopropyl 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 isopropyl 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.
- (ii) Where a fan is located in duct work and where isopropyl glycidyl ether is present in concentrations greater than 5000 ppm, the fan rotating element shall consist of, or be lined with, non-sparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

Respirators

- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:

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- (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, 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 ISOPROPYL GLYCIDYL ETHER

tion

Concentration

to or less

500 ppm or hood.

to or less

1000 ppm piece.

er than

ppm, or operated in pressure-demand or other positive pressure mode.

and Escape

Unknown air respirator with a full facepiece operated in pressure-

trations

auxiliary self-contained air supply operated in pressure-demand or other positive pressure mode.

Fighting

Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.

Any gas mask providing protection against organic vapors.

Any escape self-contained breathing apparatus.

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Fire and Safety

Employers shall familiarize themselves with the information contained in Substance Technical Guidelines for isopropyl glycidyl ether which is contained in Appendix B in order to ensure the safe handling and use of isopropyl glycidyl ether.

Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of isopropyl glycidyl ether shall be Class I Group C.

Portable fire extinguishers - For the purposes of compliance with section 1910.157, isopropyl glycidyl ether is classified as a Class B fire hazard.

Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of isopropyl glycidyl ether shall be Class I Group C.

Flammable liquids - For the purposes of compliance with section 1910.106, liquid isopropyl glycidyl ether is classified as a Class IC flammable liquid.

Sources of ignition - Sources of ignition such as smoking or open flames are prohibited where isopropyl glycidyl ether is handled, used or stored in a manner so as to create a potential fire or explosion hazard.

Storage - Isopropyl glycidyl ether shall be stored so as not to come in contact with strong oxidizers and strong caustics.

Personal Protective Equipment

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 repeated or prolonged skin contact to liquid isopropyl glycidyl ether. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall ensure that clothing contaminated with liquid isopropyl glycidyl ether is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of isopropyl glycidyl ether from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the isopropyl glycidyl ether, the employer shall inform the person performing the operation of the hazardous properties of isopropyl glycidyl ether.
- (iii) Employers shall ensure that non-impervious clothing contaminated with liquid isopropyl glycidyl ether be removed promptly and not reworn until the isopropyl glycidyl ether is removed from the clothing.
- (iv) Employers shall ensure that all clothing which becomes wet with liquid isopropyl glycidyl ether be removed immediately and not reworn until the isopropyl glycidyl ether is removed from the clothing.

Eye Contact

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- (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 isopropyl glycidyl ether may occur.

Spills

Spills of isopropyl glycidyl ether shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.

Liquid isopropyl glycidyl ether may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

Sanitation

Employers shall ensure that employees whose skin becomes contaminated with liquid isopropyl glycidyl ether promptly wash or shower using soap or mild detergent to remove any isopropyl glycidyl ether from the skin.

Employers shall ensure that employees who handle liquid isopropyl glycidyl ether wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

Training and Information - Each employer who has employees exposed to isopropyl glycidyl ether in excess of the action level, or employees may have skin or eye contact with liquid isopropyl glycidyl ether, or employees who work where accidental release, spill, fire, or explosion of isopropyl glycidyl ether may occur, shall annually:

Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for isopropyl glycidyl ether, which is contained in Appendix A; and

Medical -

- (I) Advise employees as to the signs and symptoms of exposure to isopropyl glycidyl ether.
- (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to isopropyl 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

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 isopropyl 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.

Medical Surveillance

The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.

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**Preplacement Questionnaire** - The employer shall obtain from each employee who will be exposed to liquid isopropyl glycidyl ether, or airborne concentrations of isopropyl 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

**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).

**Results of Preplacement Examination** - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).

**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).
- (II) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to isopropyl glycidyl ether.

**Results of Periodic Examinations** - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).

**Exclusion or Removal from Exposure** - No employee shall continue to be exposed to isopropyl glycidyl ether if such exposure could place the employee at increased risk of material impairment of his health.

**Emergency Procedures** - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to isopropyl glycidyl ether.

**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 isopropyl 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.

**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 isopropyl glycidyl ether or which could significantly interfere with the ability of the employee to



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follow recommended or required procedures for protecting himself from unusual or emergency exposure.

- (B) Any recommended limitations upon the employee's exposure to isopropyl 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 isopropyl glycidyl ether.

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.

Recordkeeping.

Initial determination.

- (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.

Exposure measurements.

- (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to isopropyl 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 isopropyl 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.

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:

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- (a) Date of measurement;
- (b) Type of measurement taken;
- (c) Result of measurement.

(iii) This record shall be maintained for at least one year.

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.

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 isopropyl
  - (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.

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.

Observation of monitoring.

Duty.

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to isopropyl glycidyl ether which is conducted pursuant to this section.

Exercise of opportunity to observe monitoring.

- (i) When observation of the monitoring of employee exposure to isopropyl 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;

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(b) Visually observe all steps related to the measurement of exposure to isopropyl glycidyl ether that are being performed at the place of exposure.

(c) Record the results obtained.

Employee notification.

The employer shall notify in writing, within five work days, every employee who is found to be exposed to isopropyl 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.

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

SUBSTANCE IDENTIFICATION

STANCE: Isopropyl glycidyl ether (IGE)  
VISIBLE EXPOSURE: 50 parts of isopropyl glycidyl ether per million  
parts of air (ppm) or 240 milligrams of isopropyl glycidyl ether per  
cubic meter of air (mg/cu m)  
APPEARANCE: Colorless liquid

HEALTH HAZARD DATA

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

Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to isopropyl glycidyl ether might cause irritation of the eyes and nose.
2. Long-Term Overexposure: Long-term or repeated skin contact with this chemical 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 isopropyl glycidyl ether exposure.

EMERGENCY FIRST AID PROCEDURES

Eye Exposure: If isopropyl glycidyl ether gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists, get medical attention. Contact lenses should not be worn when working with this chemical.

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

Breathing: If you or any other person breathes in large amounts of isopropyl 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.

**Swallowing:** When isopropyl 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.

**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.

**RESPIRATORS AND PROTECTIVE CLOTHING**

**RESPIRATORS:** Respirators are not the best way to control exposure to isopropyl 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 difficulty breathing while wearing a respirator, tell your employer.

**PROTECTIVE CLOTHING:** You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent any possibility of skin contact with liquid isopropyl glycidyl ether.

**EYE PROTECTION:** You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid isopropyl glycidyl ether may occur.

**PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE**

Isopropyl glycidyl ether is a flammable liquid and its vapors easily form explosive mixtures with air. It must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames, strong oxidizers and strong caustics. Sources of ignition such as smoking and open flames are prohibited wherever isopropyl glycidyl ether is handled, used or stored in a manner that could create a potential fire or explosion hazard. You must use non-sparking tools when opening or closing metal containers of isopropyl glycidyl ether, and containers must be bonded and grounded when pouring or transferring liquid isopropyl glycidyl ether. If your skin becomes contaminated with liquid isopropyl glycidyl ether, you must immediately wash or shower with soap or mild detergent to remove any isopropyl glycidyl ether from skin. You must immediately remove any clothing that becomes wet with liquid isopropyl glycidyl ether and this clothing must not be reworn until the isopropyl glycidyl ether is removed from the clothing. If you

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For liquid isopropyl 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 isopropyl 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  
ISOPROPYL GLYCIDYL ETHER

PHYSICAL AND CHEMICAL DATA

Substance Identification

1. Synonyms: Isopropoxymethyloxiran; 1,2-epoxy-3-isopropoxypropane; glycidyl isopropyl ether; isopropyl epoxypropyl ether; IGE
2. Formula:  $C_6H_{12}O_2$
3. Molecular weight: 116.16

Physical Data

1. Boiling point (760 mm Hg): 132 C (270 F)
2. Specific gravity (water=1): 0.914
3. Vapor density (air=1 at boiling point of isopropyl glycidyl ether): 4.0
4. Melting point: Data not available
5. Vapor pressure at 25 C (77 F): 9.4 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 18.8
7. Evaporation rate (butyl acetate=1): Data not available
8. Appearance: Colorless liquid

FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

Fire

1. Flash point: 33 C (92 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishing media: Carbon dioxide, alcohol foam, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Isopropyl glycidyl ether is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where isopropyl glycidyl ether is handled, used or stored. Isopropyl glycidyl ether vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which isopropyl glycidyl ether is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, isopropyl glycidyl ether is classified as a Class IC flammable liquid.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for isopropyl glycidyl ether shall be Class I Group C.

Reactivity

1. Conditions contributing to instability: Heat

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

SPILL, LEAK AND DISPOSAL PROCEDURES

If isopropyl 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 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. Isopropyl glycidyl ether may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

Waste disposal methods:

Isopropyl glycidyl ether may be disposed of by atomizing in a suitable combustion chamber, or absorbing on vermiculite, dry sand, earth or similar material and disposing of in a sanitary landfill.

MONITORING AND MEASUREMENT PROCEDURES

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 isopropyl glycidyl ether to plus or minus 35%.

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 isopropyl glycidyl ether to plus



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

MISCELLANEOUS PRECAUTIONS

Store isopropyl glycidyl ether in tightly closed containers in a cool, well-ventilated area.

High exposures to isopropyl glycidyl ether can occur when transferring the liquid from one container to another.

Non-sparking tools must be used to open and close metal isopropyl glycidyl ether containers. These containers must be effectively grounded and bonded prior to pouring.

Employers must advise employees of all plant areas and operations where exposure to isopropyl glycidyl ether could occur.

COMMON OPERATIONS

Common operations in which exposure to isopropyl glycidyl ether is likely to occur are: during its production and its use as a reactive agent for epoxy resins, as a chemical intermediate for the synthesis of ethers and esters and as a stabilizing agent for organic chemicals. These uses are generally found in the laboratory and, as such, isopropyl glycidyl ether is not used industrially or commercially.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

ROUTE OF ENTRY

Instillation; skin absorption.

TOXICOLOGY

Isopropyl glycidyl ether is primarily an irritant to the eyes, upper respiratory tract and skin. It is also a skin sensitizer. The LC50 values were 1,500 ppm in the mouse after 4 hours exposure and 1,100 ppm in the rat after 8 hours. Exposures above 500 ppm resulted in chemical conjunctivitis, but rats tolerated 400 ppm of repeated exposure with little effect. Moderate irritation resulted from instillation of the liquid in the eye, and moderate irritation from application to the skin of rabbits. Absorption through the skin has been demonstrated. The intragastric LD50 was 1.30 g/kg in mice and 4.20 g/kg in rats, producing central nervous system depression. No chronic systemic effects have been reported in humans.

SIGNS AND SYMPTOMS

Irritation of the eyes, upper respiratory tract and skin. Possible skin sensitization.

SPECIAL TESTS

None in common usage.

TREATMENT

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

SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

GENERAL

Most reported effects of isopropyl glycidyl ether are caused by its irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to isopropyl 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.

PREPLACEMENT

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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 isopropyl glycidyl ether exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- Isopropyl 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 isopropyl 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 isopropyl 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 isopropyl glycidyl ether might cause exacerbation of symptoms due to its irritant properties.

#### 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.

nces

American Conference of Governmental Industrial Hygienists: "Isopropyl Glycidyl Ether," (3d ed., 2d printing), Documentation of the Old Limit Values for Substances in Workroom Air, Cincinnati, 1974, 2-143.

Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, pp. 1637-1638.

Hine, C.H., et al.: "Toxicology of Glycidol and Some Glycidyl Compounds," A.M.A. Archives of Industrial Health, 14:250-264,

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REFERENCES AND SOURCES  
ISOPROPYL GLYCIDYL ETHER  
1910.93

Methods of Compliance

- (1) Engineering Controls - In the absence of definitive data on the lower flammable limit of isopropyl glycidyl ether, 5000 ppm was estimated to be the level above which non-sparking materials are required to minimize fire or explosion hazards from fan construction.

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.

Personal Protective Equipment, and (h) Sanitation

Eye: Patty, "Ind. Hyg. and Tox.;" Grant, "Toxicology of the Eye"

Skin: Documentation in Support of TLV; Patty, "Ind. Hyg. and Tox.;" 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: Patty, "Ind. Hyg. and Tox."

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Patty notes that it is moderately irritating to the eyes. Grant states that isopropyl glycidyl ether tested by application of a drop to rabbit eyes has been found to cause moderate reversible corneal injury.

A classification of 2 is therefore concluded to be appropriate.

Skin - Classification: 2

Output statement numbers: 2, 7a, 17g and 21 combined, 17i, 20a

Exceptions: None

Documentation of TLV's gives a skin penetration of LD50 for rabbits of 9.65 g/kg. Patty states that it is moderately irritating to the skin and capable of causing skin sensitization, that it is practically nontoxic following absorption through the skin, and that it has not demonstrated radiomimetic effects. Its flash point is 92 degrees F, it is 18.8% soluble in water, and its vapor pressure at 25 C is 9.4 mm Hg. Repeated contact can cause dermatitis. Examination of the available literature concerning this material did not definitively prove that it is a strong sensitizer; therefore, it is given a hazard classification of 2.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Patty considers it to be slightly toxic following ingestion. The intragastric rat LD50 is 4.20 g/kg.

SUBSTANCE TECHNICAL GUIDELINES  
ISOPROPYL GLYCIDYL ETHER

PHYSICAL AND CHEMICAL DATA

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Substance Identification

1. Synonyms: Isopropoxymethyloxiran; 1,2-epoxy-3-isopropoxypropane; glycidyl isopropyl ether; isopropyl epoxypropyl ether; IGE
2. Formula: C<sub>6</sub>H<sub>12</sub>O<sub>2</sub>
3. Molecular weight: 116.16

Physical Data

1. Boiling point (760 mm Hg): 132 C (270 F)
2. Specific gravity (water=1): 0.914
3. Vapor density (air=1 at boiling point of isopropyl glycidyl ether): 4.0
4. Melting point: Data not available
5. Vapor pressure at 25 C (77 F): 9.4 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 18.8
7. Evaporation rate (butyl acetate=1): Data not available
8. Appearance: Colorless liquid

FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

Fire

1. Flash point: 33 C (92 F) (closed cup)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishing media: Carbon dioxide, alcohol foam, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Isopropyl glycidyl ether is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where isopropyl glycidyl ether is handled, used or stored in a manner that could create a potential fire or explosion hazard. Isopropyl glycidyl ether vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which isopropyl glycidyl ether is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, isopropyl glycidyl ether is classified as a Class IC flammable liquid.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for isopropyl glycidyl ether shall be Class I Group C.

Reactivity

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

SPILL, LEAK AND DISPOSAL PROCEDURES

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If isopropyl 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. Evaporate in a safe place (such as a fume hood). Allow sufficient time for vapors to completely clear hood ductwork, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. Isopropyl glycidyl ether may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

Waste disposal methods: Isopropyl glycidyl ether may be disposed of by atomizing in a suitable combustion chamber.

#### MONITORING AND MEASUREMENT PROCEDURES

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 isopropyl glycidyl ether to plus or minus 35%.

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 isopropyl glycidyl ether to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

#### MISCELLANEOUS PRECAUTIONS

Store isopropyl glycidyl ether in tightly closed containers in a cool, well-ventilated area.

High exposures to isopropyl glycidyl ether can occur when transferring the liquid from one container to another.

Non-sparking tools must be used to open and close metal isopropyl glycidyl ether containers. These containers must be effectively grounded and bonded prior to pouring.

Employers should advise employees of all plant areas and operations where exposure to isopropyl glycidyl ether could occur.

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COMMON OPERATIONS

Common operations in which exposure to isopropyl glycidyl ether is likely to occur are: during its production and its use as a reactive agent for epoxy resins, as a chemical intermediate for the synthesis of esters and esters and as a stabilizing agent for organic chemicals. These uses are generally found in the laboratory and, as such, isopropyl glycidyl ether is not used industrially or commercially.

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USE/EXPOSURE AND CONTROL DOCUMENT  
PHENYL GLYCIDYL ETHER

| Use/Exposure                                                                                                                                                                                                                                                                                     | Principal Route of Entry | Currently Used Control Methods                                                                                                                    |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------|
| 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                                               |
| 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)                                          |
| 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                                                |
| 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) |
| 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)                        |
| Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage drums or during                                                                                                                                                                                      | A,B                      | Local exhaust ventilation; general dilution ventilation; personal protective devices (respirator, gloves,                                         |



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cleanup of accidental spills

goggles)

Inhalation of vapor and skin  
contact with liquid during  
treatment of fabrics to  
impart them with crease  
and abrasion resistance

A,B

Local exhaust ventilation;  
general dilution ventila-  
tion; personal protective  
equipment (gloves, goggles)

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