

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** PHENYL ETHER ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for PHENYL 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 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 ether in concentrations not in excess of 1 parts per million (ppm) (7 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 ether.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which phenyl 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 ETHER - Inform affected employees of the quantity, location, and manner of use or storage of phenyl ether.

(c) EXPOSURE MEASUREMENT

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

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concentrations of phenyl 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 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 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 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 phenyl ether is present in concentrations greater than 2000 ppm, one fourth of the lower flammable limit, 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.

(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

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- (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 Phenyl Ether

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 50 ppm	and organic vapor cartridge(s) and dust, fume, and mist filter. A gas mask with a chin-style or front or back mounted organic vapor canister and 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
Equal to or less than 100 ppm	operated in pressure-demand or other positive pressure mode with a full facepiece, hood, or helmet operated in continuous flow mode.
Greater than 100 ppm or Entry & Escape Unknown Concentrations	operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand positive pressure or continuous flow mode and an auxiliary, self-contained air supply operated in pressure-demand or other
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.

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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 ether which is contained in Appendix B in order to ensure the safe handling and use of phenyl ether.

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of solid phenyl ether shall be Class II Group G and for liquid phenyl ether shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, phenyl 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 solid phenyl ether shall be Class II Group G and for liquid phenyl ether shall be Class I Group D.
- (4) Combustible liquids - For the purposes of compliance with section 1910.106, liquid phenyl 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 ether is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - Phenyl ether shall be stored so as not to come in contact with strong oxidizers.

(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 repeated or prolonged skin contact to liquid or solid phenyl ether. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall ensure that any non-impervious clothing which becomes wet with liquid phenyl ether or contaminated with solid phenyl ether be removed promptly and not reworn until the phenyl 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 or solid phenyl ether may occur.

(h) Spills

- (1) Spills of phenyl ether shall be cleaned up immediately after utilizing available ventilation.

-(i) Sanitation

- (1) Employers shall ensure that employees whose skin becomes wet with liquid phenyl ether or contaminated with solid phenyl ether, promptly wash or shower using soap or mild detergent to remove any phenyl ether from the skin.

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- (j) Training and Information - Each employer who has employees exposed to phenyl ether in excess of the action level, or employees who may have skin or eye contact with phenyl ether, or employees who work where accidental release, spill, fire, or explosion of phenyl 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 ether, which is contained in Appendix A; and
 - (2) Medical -
 - (I) Advise employees as to the signs and symptoms of exposure to phenyl ether.
 - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to phenyl 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 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 airborne concentrations of phenyl 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).
 - (II) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to phenyl 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).

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- (7) Exclusion or Removal from Exposure - No employee shall continue to be exposed to phenyl 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 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 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 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 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 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.
 - (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.

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- (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 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 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 phenyl ether;
 - (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.

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- (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 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 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 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 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 ether

PERMISSIBLE EXPOSURE: 1 part of phenyl ether per million parts of air (ppm) or 7 milligrams of phenyl ether per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless solid or liquid with a disagreeable odor.

II. HEALTH HAZARD DATA

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

B. Effects of Overexposure:

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

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If phenyl 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.

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

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- C. Breathing: If you or any other person breathes in large amounts of phenyl ether remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When phenyl 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 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 can smell phenyl 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 repeated or prolonged skin contact with liquid or solid phenyl 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 ether may occur. You must wear dust-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to solid phenyl ether may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Phenyl 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, sparks, flames and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever phenyl ether is handled, used or stored in a manner that could create a potential fire or explosion hazard. If your skin becomes contaminated with solid phenyl ether, you

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must promptly wash or shower using soap or mild detergent to remove the phenyl ether from your skin. You must promptly remove any non-impervious clothing that becomes contaminated with solid phenyl ether and this clothing must not be reworn until the phenyl ether is removed from the clothing. If your skin becomes wet with liquid phenyl ether, you must promptly wash or shower using soap or mild detergent together with powdered pumice, borax or other suitable cleanser to remove the phenyl ether from your skin. You must promptly remove any non-impervious clothing that becomes wet with liquid phenyl ether and this clothing must not be reworn until the phenyl ether is removed from the clothing. 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 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 ETHER

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: Diphenyl ether; diphenyl oxide
 - 2. Formula: $(C_6H_5)_2O$
 - 3. Molecular weight: 170.2
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 259 C (498 F)
 - 2. Specific gravity (water=1): 1.1
 - 3. Vapor density (air=1 at boiling point of phenyl ether): 5.86
 - 4. Melting point: 27 C (81 F) (maximum value)
 - 5. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
 - 6. Solubility in water, % by weight at 20 C (68 F): 0.0021
 - 7. Evaporation rate (butyl acetate=1): Data not available
 - 8. Appearance and odor: Colorless solid or liquid with a somewhat disagreeable odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Flash point: 115 C (239 F) (closed cup)
 - 2. Autoignition temperature: 620 C (1148 F)
 - 3. Flammable limits in air, % by volume: Lower: 0.8; Upper: 1.5
 - 4. Extinguishing media: Foam, dry chemical, carbon dioxide
 - 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: Liquid phenyl ether is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where phenyl 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, liquid phenyl ether is classified as a Class IIIB combustible 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 shall be Class II, Group G for solid phenyl ether, and shall be Class I, Group D for liquid phenyl ether.
 - B. Reactivity
 - 1. Conditions contributing to instability: Heat

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

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. If phenyl ether is spilled or leaked, the following steps should be taken:
 1. Ventilate area of spill or leak
 2. For small quantities, absorb or scoop up on paper. Remove to a safe place and burn the paper. Large quantities may be reclaimed; however, if this is not practical, collect, dissolve in an appropriate solvent, and atomize 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 ether may be disposed of by dissolving in an appropriate solvent and 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 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 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 ether to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

- A. Store phenyl ether in tightly closed containers in a well-ventilated area away from heat.

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

VI. COMMON OPERATIONS

Common operations in which exposure to phenyl ether is likely to occur are: its use in the formulation of heat transfer fluids such as Dowtherm; its use as a chemical intermediate; and during the manufacture of surfactants, plasticizers, perfumes, soaps and flavoring agents for food.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Phenyl ether is an irritant to the skin and eyes and has an objectionable odor which may cause nausea. Information regarding the physiologic effects of the liquid is not extensive, but it appears to be low in oral toxicity. The acute lethal dose for rats and guinea pigs is 4 g/kg. Animals that survived oral doses of 1 to 2 g/kg showed some injury to the liver, kidneys, spleen and thyroid. No chronic systemic effects have been reported in humans.

III. SIGNS AND SYMPTOMS

Nausea in some individuals; potential irritation of the eyes and nose. Prolonged exposure to liquid may cause mild skin irritation.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes and skin with water. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

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

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

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1. Skin disease -- Phenyl ether may cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Liver disease -- Although phenyl 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 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 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 Ether," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, pp. 205-206.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1698-1701.

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(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 Protective Equipment, and (h) Sanitation

Eye: Patty, "Ind. Hyg. and Tox.;" Documentation of TLV's; Dow MSDS; Grant, "Toxicology of the Eye"

Skin: Patty, "Ind. Hyg. and Tox.;" International Labour Office, "Encyclopedia of Occupational Health and Safety;" Documentation of TLV's

Ingestion: Patty, "Ind. Hyg. and Tox."

COMMENTS

Eye - Classification: 2 and 6

Output statement numbers: 10 and 12 combined into one statement

Exceptions: None

Patty states that contact of the eye with liquid mists has consequences which are not serious. Documentation of TLV's notes that the effects of eye application resemble closely those found with the eutectic mixture with diphenyl. The liquid eutect mixture is noted in Patty as causing pain and transient irritation to the eyes. The Dow MSDS for the mixture states that mild to moderate inflammation will occur and that the material is "unlikely to cause injury." All of the above appears to be referring to the effects of the liquid. Since the melting point of the material is about 100°C it is also assumed that eye contact with the solid must be avoided. Grant reports that "in 4 . . . cases listed as corneal burns from diphenyl oxide, recovery was complete within 48 hours."

Classifications of 2 and 6 are concluded to be appropriate.

Skin - Classification: 2 and 6

Output statement numbers: 2, 17g, 17i, 20a

Exceptions: See below

Patty states that "skin" tests conducted on rabbits indicate that the undiluted material is somewhat irritating if exposures are prolonged or repeated. Effects from such an exposure are characterized by erythema and exfoliation, which clears promptly upon cessation of exposure. It is further noted that "when the material is diluted, as in perfume compositions, it does not appear to present any hazard of skin irritation." ILO notes that the substance is only slightly irritating to the skin and occasional brief contact does not have any effect. Irritation occurs only after repeated and prolonged contact. Documentation of TLV's notes that "no indication is given that skin absorption is of health significance."

Phenyl ether has a melting point of 81 degrees F (maximum value). It is 0.0021% soluble in water and has a flash point of 239 degrees F.

Avoidance of repeated or prolonged contact will prevent all cited effects. The substance is therefore assigned classification of 2 and 6. The hazard is, however, not considered serious enough

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to warrant use of statements 5b, 7a, and 7b.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Patty gives an oral LD50 for rats of 3.99 g/kg and notes that the substance is low in acute oral toxicity. Repeated feeding studies have been conducted which have resulted in some organic injury, but sufficient details are not available to allow discussion of results. Given the rather low toxicity and specific data regarding the end mixture with diphenyl, it is concluded that the probability of harm from ingestion is remote.

SUBSTANCE TECHNICAL GUIDELINES
PHENYL ETHER

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Diphenyl ether; diphenyl oxide
2. Formula: $(C_6H_5)_2O$
3. Molecular weight: 170.2

B. Physical Data

1. Boiling point (760 mm Hg): 259 C (498 F)
2. Specific gravity (water=1): 1.1
3. Vapor density (air=1 at boiling point of phenyl ether): 5.86
4. Melting point: 27 C (81 F) (maximum value)
5. Vapor pressure at 20 C (68 F): Less than 1 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.0021
7. Evaporation rate (butyl acetate=1): Data not available
8. Appearance and odor: Colorless solid or liquid with a somewhat disagreeable odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 115 C (239 F) (closed cup)
2. Autoignition temperature: 620 C (1148 F)
3. Flammable limits in air, % by volume: Lower: 0.8; Upper: 1.5
4. Extinguishing media: Foam, dry chemical, carbon dioxide
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: Liquid phenyl ether is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where phenyl 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, liquid phenyl ether is classified as a Class IIIB combustible 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 shall be Class II, Group

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G for solid phenyl ether, and shall be Class I, Group D for liquid phenyl ether.

B. Reactivity

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

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If phenyl ether is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak
2. For small quantities, absorb or scoop up on paper. Remove to a safe place and burn the paper. Large quantities may be reclaimed; however, if this is not practical, collect, dissolve in an appropriate solvent, and atomize 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 ether may be disposed of by dissolving in an appropriate solvent and 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 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 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 ether to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

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V. MISCELLANEOUS PRECAUTIONS

- A. Store phenyl 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 ether could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to phenyl ether is likely to occur are: its use in the formulation of heat transfer fluids such as Dowtherm; its use as a chemical intermediate; and during the manufacture of surfactants, plasticizers, perfumes, soaps and flavoring agents for food.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Phenyl ether (vapor)

D. O. L. STANDARD: 1 ppm

WARNING PROPERTIES:

Odor Threshold: Staub reports an odor threshold for phenyl ether of 0.01 ppm, and Stern reports 0.001 ppm

Eye Irritation Level: The Documentation of TLV's states that "effects of . . . eye application (of phenyl ether) resemble closely those found for the eutectic mixture with diphenyl; phenyl ether in concentrated prolonged exposures is somewhat irritating but is not so in dilution." The phenyl ether - diphenyl mixture is known to produce eye irritation at 3-4 ppm (Grant). For the purposes of this standard only full facepiece respirators are permitted.

Evaluation of Warning Properties: Since the odor threshold of phenyl ether is lower than the permissible exposure limit, this substance is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: Unknown. In the available toxicological information, there is no evidence of an IDLH concentration for phenyl ether. Patty states that "its vapors do not present a toxicological problem, but may be a nuisance due to disagreeableness." For the purposes of this standard, therefore, respirators have been selected on the basis of the protection factor afforded by each device up to a concentration of 100 ppm. High concentrations of the vapor are unlikely to be encountered in the workplace because of the high boiling point and low vapor pressure of this substance.

Other Toxicological Information: The Documentation of TLV's states that "like the eutectic mixture phenyl ether-diphenyl, industrial experience has shown no evidence that phenyl ether, either as liquid mist or vapor, is a health hazard under ordinary conditions of manufacture, handling or use. Although a great deal more toxicologic data and experience are available for the mixture than for phenyl ether alone, rough comparison shows phenyl ether has no overt systemic toxicity at concentrations that are not intolerably disagreeable. The acute lethal oral dose for rats and guinea pigs approximates 4 g/kg, and single doses between 1 g/kg and 2 g/kg, permitted survival, depending on species. Surviving animals, however, were reported to show injury to the liver, spleen, kidneys, throid and intestinal tract. This generalized organ injury may be a reflection of the rather general non-specific capacity of

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aromatic nuclei to inhibit a number of critical body enzyme activities. Hake and Rowe recommended control of vapor concentrations to below 1 ppm to avoid 'complaints of disagreeable odor and in some cases, nausea.'

Patty reports that "information regarding the physiological effects of phenyl ether is not extensive. It appears to be low in oral toxicity, not appreciably irritating to the skin, and its vapors do not present a toxicological problem, but may be a nuisance due to disagreeableness. . . The vapor toxicity of diphenyl ether has not been determined directly. However, some experiments on materials that consisted largely of this compound have indicated that vapor concentrations that can occur at ordinary room temperatures present no hazard of systemic injury. It should be noted that such concentrations are quite low because of the low vapor pressure of the material and, furthermore, that such concentrations have an odor which may be disagreeable. . . Experience in manufacturing, handling, and selling this material over many years has indicated that the material does not present an appreciable hazard to health as ordinarily used."

LFL: 8000 ppm

VAPOR PRESSURE AT 20 C: Less than 1 mm Hg (0.0213 mm Hg at 25 C, according to Patty)

SATURATED CONCENTRATION AT 25 C: 28 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
PHENYL ETHER

Principal Route
of Entry

Currently Used
Control Methods

- | Use/Exposure | Principal Route
of Entry | Currently Used
Control Methods |
|--|-----------------------------|---|
| 1. Inhalation of vapor where used as a high temperature heat transfer medium (marketed as Dow Therm A Thermax, Diphyl, and Gilotherm) | A | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices) |
| 2. Inhalation of vapor and skin contact with liquid during cleaning and maintenance of processing equipment where phenyl ether is a side product of the production of phenol. Included are vacuum columns and storage vessels | A,B | Personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 3. Inhalation of vapor and skin contact with liquid when used as an intermediate in further organic syntheses. protective devices)
Among products resulting from such reactions are: epoxy resins, other phenol based-heat resistant resins, polysulfone resins, high - temperature lubricants, surfactants, specialty plasticizers, varnishes, phenol-formaldehyde resins, artificial sweetener, insecticides, preservatives, fire retardants and adhesives. | A,B | General dilution ventilation; personal protective equipment (gloves, aprons, goggles, and respiratory |
| 4. Skin contact with liquid during the manufacture of soaps and perfumes in which phenyl ether is used as an odorant | B | Personal protective equipment (gloves, aprons, and goggles) |
| -5. Skin contact with liquid during the manufacture of food products in which phenyl ether is used as a flavoring agent | B | Personal protective equipment (gloves, aprons and goggles) |

A -- Inhalation

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

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

1,218 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

[illegible]