

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** ISOPROPYLETHER ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ISOPROPYLETHER

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 ISOPROPYLETHER.

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" means exposure of employees to airborne concentrations of isopropylether not in excess of 500 parts per million (ppm) (2100 milligrams per cubic meter (mg/M3)) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one-half of the permissible exposure for isopropylether averaged over an eight-hour work shift.

(b) Initial determination and exposure measurement. (1) Each employer who has a place of employment in which isopropylether is released into the workplace air shall determine if there is any possibility that any employee may be exposed to airborne concentrations of isopropylether above the permissible level. The initial determination shall be made each time there is a change in production, process, or control measures which may result in an increase in airborne concentrations of isopropylether.

(2) A written record of the initial determination shall be made and shall contain at least the following information:

(i) Any information, observations, or calculations which may indicate employee exposure to isopropylether;

(ii) Any measurements of isopropylether taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to isopropylether; and

(iv) Date of initial determination, work being performed at the time, location within work site, and employees considered.

(3) If the employer determines that any employee may be exposed to isopropylether above the permissible exposure, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to isopropylether above the action level, the employer shall:

(i) Identify all employees who may be exposed above the permissible level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to isopropylether above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every three months.

(6) If an employee exposure measurement reveals that an employee is exposed to isopropylether above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (d) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to isopropylether above the permissible exposure. The employee shall also be notified of the results of the exposure measurements and of the corrective action being taken to reduce the exposure to below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to isopropylether below the action level, the employer may terminate measurement for the employee.

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(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement. (1) 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 (See Appendix B (IV) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95 percent, of not less than that given in Table 1.

Table 1

Concentration	Required Accuracy (Percent of True Value)
Above permissible exposure	± 25
At or below permissible exposure and above the action level	± 35
At or below the action level	± 50

(d) Compliance. (1) No employee shall be exposed to isopropylether above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of isopropylether shall be controlled to at or below the permissible exposure by engineering and work practice controls.

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. (i) When local exhaust is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity or static pressure, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of isopropylether.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving isopropylether shall be classified as C-1 at 21 degrees C (70 degrees F.)

(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

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- (ii) In work situations in which engineering and work practice controls are not feasible; or
 - (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of isopropylether to at or below the permissible exposure; or
 - (iv) For operations which require entry into tanks or closed vessels; or
 - (v) In emergencies.
- (5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR ISOPROPYLETHER

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION

Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with a full facepiece and an organic vapor cartridge(s).
5000 ppm or less	A gas mask with a chin-style organic vapor canister.
10,000 ppm or less	A gas mask with a front- or back-mounted organic vapor canister.
	Any supplied-air respirator with a full facepiece, helmet or hood.
	Any self-contained breathing apparatus with a full facepiece.
Greater than 10,000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors.
	Any escape self-contained breathing apparatus.

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(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. (1) The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for isopropylether.

(2) For the purpose of compliance with § 1910.309, locations classified as hazardous locations due to the presence of isopropylether shall be Class I, Group C.

(3) For the purpose of compliance with § 1910.157, isopropylether is classified as a Class B fire hazard.

(4) For the purpose of compliance with § 1910.178, locations classified as hazardous locations due to the presence of isopropylether shall be Class I, Group C.

(5) For the purpose of compliance with § 1910.106, liquid isopropylether is classified as a Class IB flammable liquid.

(6) Spray finishing operations shall be performed in accordance with §§ 1910.107 and 1910.94(c).

(7) Dip tank operations shall be performed in accordance with §§ 1910.108 and 1910.94(d).

(8) Where a fan is located in ductwork and where isopropylether is present in the ductwork in concentrations greater than 3500 ppm (approximately 25% of the lower flammable limit), the fan rotating element shall be of nonsparking material or the casing shall consist of, or be lined with, nonsparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(9) Sources of ignition such as smoking or open flames are prohibited where isopropylether presents a fire or explosion hazard.

(10) Isopropylether shall be stored so as not to come in contact with strong oxidizers and air.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use appropriate protective clothing and equipment necessary to prevent repeated or prolonged skin contact with liquid isopropylether. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that clothing wet with isopropylether is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of isopropylether from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the isopropylether, the employer shall inform the person performing the operation of the hazardous properties of isopropylether.

(3) Employers shall ensure that clothing which becomes wet with liquid isopropylether be removed immediately and not reworn until the isopropylether is removed from the clothing.

(4) Employers shall provide and ensure that employees use splash-proof safety goggles which comply with § 1910.133(a)(2)-(a)(6) where liquid isopropylether may contact the eyes.

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(g) Spills and disposal. (1) In the event that liquid isopropylether is spilled the employer shall immediately eliminate potential sources of ignition, provide available ventilation and then clean up the spill.

(2) Liquid isopropylether shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion. Sewers designed to preclude the formation of explosive vapors are permitted.

(h) Sanitation. Employers shall ensure that employees whose skin becomes wet with liquid isopropylether promptly wash or shower with soap or mild detergent and water to remove any isopropylether from the skin.

(i) Training and information. (1) Each employer who has a workplace in which isopropylether is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to isopropylether above the action level without regard to the use of respirators, or employees who may have repeated or prolonged skin contact, or who may have eye contact with liquid isopropylether, or employees who work where isopropylether presents a fire or explosion hazard shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for isopropylether (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to isopropylether.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to isopropylether which are listed in Appendix A of the section;

(iv) Instruct affected employees to inform the employer if they develop any of the medical conditions listed in paragraph (j)(2) of this section; and

(v) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to isopropylether.

(j) Medical surveillance. (1) The employer shall provide medical procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

(2) Each employer who has employees exposed to airborne concentrations of isopropylether above the action level, without regard to the use of respirators, or employees who may have repeated or prolonged skin contact or who may have eye contact with liquid isopropylether shall obtain information as to whether such employee has a history of any of the following medical conditions:

(i) Chronic lung disease; and

(ii) Skin disease.

(3) The employer shall provide a medical examination for the employee if:

(i) The employee provides a history of any of the medical conditions listed in paragraph (j)(2) of this section; or

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to isopropylether which are listed in Appendix A which the employee suspects are caused by exposure to isopropylether.

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(4) The employer shall provide to the examining physician the following information:

(i) A copy of this regulation with Appendixes A, B and C for isopropylether;

(ii) A description of the affected employee's duties as they relate to his exposure to isopropylether;

(iii) A description of any personal protective equipment and respirators required to be used;

(iv) The results of any measurements which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure; and

(vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(5) Where a medical examination is required by paragraph (j)(3) of this section, following such examination the employer shall obtain a written opinion from the examining physician which conforms with paragraph (j)(6) of this section.

(6)(i) The physician's written opinion by the examining physician shall specifically state: (A) Whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to isopropylether;

(B) Any recommended limitations upon the employee's exposure to isopropylether including limitations upon the use of personal protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnoses unrelated to the employee's employment.

(iii) The employer shall provide the employee with a copy of the physician's written opinion.

(7) No employee shall be exposed to isopropylether in such a way as would put the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available including the physician's written opinion.

(8) The employer shall provide emergency medical treatment for any employee injured through exposure to isopropylether.

(9) 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 risk involved by refusal to be examined.

(10) No medical procedure which would be performed pursuant to this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) This record shall include the written determination required in paragraph (b)(2) of this section.

(iii) This record shall be maintained until replaced by a more recent record.

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(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to isopropylether.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to isopropylether which are being monitored;

(C) Sampling and analytical method used and evidence of their accuracy;

(D) Number, duration, and results of samples taken; and

(E) Name 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 an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) This record shall include:

(A) The name of the employee;

(B) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;

(C) Any employee medical complaints relative to exposure to isopropylether;

(D) A copy of information provided to the physician pursuant to paragraph (j)(4)(ii), (iii), (iv), (v), and (vi) of this section.

(E) Physician's written opinion; and

(F) A signed statement of any refusal to be examined.

(iii) This record shall be maintained for the duration of and for one year after termination of the employment of the affected employee.

(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

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(ii) Each employee or former employee shall have access to the exposure determination and exposure measurement records required to be maintained by this section which indicate his own exposure to isopropylether.

(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.

(1) Employee observation of measurement. (1) The employer shall give each employee or his representative an opportunity to observe any measurement of his exposure to isopropylether which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to isopropylether requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

(i) Receive an explanation of the measurement procedure.

(ii) Visually observe all steps related to the measurement of the airborne concentration of isopropylether that are being performed at the place of exposure; and

(iii) Record the results obtained.

NOTE: The information contained in the following appendix for isopropylether is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent that the information supplements this regulation for isopropylether, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR ISOPROPYLETHER

I. SUBSTANCE IDENTIFICATION

A. Substance: Isopropylether

B. Permissible Exposure: 500 parts of isopropylether per million parts of air (ppm) (2100 milligrams of isopropylether per cubic meter of air (mg/M3)) averaged over an eight-hour work shift.

C. Appearance and Odor: Colorless liquid with a sharp, sweet, ether-like odor

II. HEALTH HAZARD DATA

A. Ways in which the chemical affects your body: Isopropylether can affect your body if you inhale it or if it comes in

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contact with your eyes or skin. It may also affect your body if you swallow it.

B. Effects of Overexposure:

1. Short-term Exposure: Strong concentrations of isopropylether vapors may cause irritation of the eyes and nose. Animal experiments suggest that exposure to high concentrations of this chemical may cause drowsiness, dizziness and unconsciousness.
2. Long-term Exposure: Repeated or prolonged exposure to liquid isopropylether may cause dryness and irritation of your skin.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to isopropylether.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If liquid isopropylether gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If liquid isopropylether gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If liquid isopropylether soaks through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation is present after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of isopropylether move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When isopropylether has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.
- 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 emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to isopropylether. You can only be required to wear them for routine use if your employer is in the process of installing controls or 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

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(MESA) or 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 isopropylether 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 appropriate protective clothing and equipment to prevent repeated or prolonged skin contact with liquid isopropylether. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles where liquid isopropylether may contact your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Isopropylether is a flammable liquid. Its vapors can easily form explosive mixtures with air.
- B. Isopropylether must be stored in tightly closed containers in a cool, well ventilated area away from strong oxidizers and air. Isopropylether may form explosive peroxides when stored in prolonged contact with air. These peroxides may be detonated by heat or shock.
- C. Sources of ignition such as smoking and open flames are prohibited wherever isopropylether is handled, used or stored in a manner that could create a potential fire or explosion hazard.
- D. Metal containers in operations involving the transfer of five gallons or more of isopropylether should be grounded and bonded.
- E. Clothing wet with liquid isopropylether can be easily ignited. You must immediately remove this clothing and it must not be reworn until the isopropylether is removed from the clothing.
- F. If your skin becomes wet with liquid isopropylether, you must promptly wash or shower with soap or mild detergent and water to remove any isopropylether from your skin.
- G. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- H. Ask your supervisor where isopropylether is used in your work area and for any additional safety and health rules.

VI. ACCESS TO INFORMATION

- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for isopropylether. In addition, your employer must instruct you in the safe use of isopropylether, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to isopropylether. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines

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that you are being overexposed, he is required to inform you of the exposure and the actions which are being taken to reduce your exposure.

- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data during your employment, and for a period of one year following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physicians written opinion for any physical examination required by this standard.

NOTE: The information contained in the following appendix for isopropylether is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent that the information supplements this regulation for isopropylether, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR ISOPROPYLETHER

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: Diisopropyl ether; 2-isopropoxypropane
 - 2. Formula: $((\text{CH}_3)_2\text{CH})_2\text{O}$
 - 3. Molecular weight: 102.2
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 68.9 C (156 F)
 - 2. Specific gravity (water = 1): 0.7
 - 3. Vapor density (air = 1 at boiling point of isopropyl-ether): 3.5
 - 4. Melting point: -85 C (-121 F)
 - 5. Vapor pressure at 20 C (68 F): 119 mm Hg
 - 6. Solubility in water, grams of isopropylether per 100 grams of water: 0.2
 - 7. Evaporation rate (butyl acetate = 1): 8
 - 8. Appearance and odor: Colorless liquid with a sharp, sweet, ether-like odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Flash point: -27.8 C (-18 F) (closed cup)

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2. Autoignition temperature: 443 C (830 F)
3. Flammable limits in air, % by volume: Lower: 1.4;
Upper: 7.9
4. Extinguishing media: Alcohol 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: Isopropylether is a
flammable liquid. Its vapors can easily form explosive
mixtures with air. All ignition sources must be
controlled where isopropylether is used, handled or
stored in a manner that could create a potential fire or
explosion hazard. Isopropylether 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 isopropylether is handled.
7. For purposes of conforming with the requirements of 29
CFR 1910.106, isopropylether is classified as a Class IB
flammable liquid. For example, 3500 ppm, approximately
one-fourth of the lower flammable limit, is one
situation in which isopropylether is considered to be a
potential fire and explosion hazard.
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
isopropylether shall be Class I, Group C.

B. Reactivity

1. Conditions contributing to instability: Contact with
air causes formation of explosive peroxides that may
detonate when heated or subjected to shock.
2. Incompatibilities: Contact with strong oxidizers may
cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and
vapors (such as carbon monoxide) may be released in a
fire involving isopropylether.
4. Special precautions: Isopropylether will attack some
forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isopropylether 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 reclaimed or
collected and atomized in a suitable combustion chamber.
Isopropylether must not be allowed to enter a confined
space, such as a sewer, because of the possibility of an
explosion. Sewers designed to preclude the formation of

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explosive concentrations of isopropylether are permitted.

- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Isopropylether may be disposed of by atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the eight-hour exposure may be determined from a single eight-hour sample or two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84, portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analysis. The method of measurement must determine the concentration of isopropylether to plus or minus 35%.
- B. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring and measurements 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. The method of measurement must determine the concentration of isopropylether to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under the title "NIOSH Analytical Methods for Set V" (Order number XXXXXXXXXXXX).
- D. QUALIFIED PERSONS: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store isopropylether in tightly closed containers in a cool, well ventilated area.
- B. High exposures to isopropylether can occur when transferring the liquid from one container to another.
- C. Metal containers in operations involving the transfer of five gallons or more of isopropylether should be grounded and bonded.
- D. Employers should advise employees of all areas and operations where their exposure to isopropylether could occur.

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VI. COMMON OPERATIONS

Common operations in which exposure to isopropylether are likely to occur are: During its production and its use as an extraction or reaction solvent; during its use as a solvent for rubber adhesives, textile spot cleaning, in the manufacture of pharmaceuticals and smokeless gunpowder, and in organic synthesis.

NOTE: The information contained in the following appendix for isopropylether is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent the information supplements this regulation for isopropylether, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Isopropylether vapor is a mild irritant of the eyes and mucous membranes; high levels cause narcosis in animals. Animals exposed to 30,000 ppm for 1 hour showed signs of narcosis. Exposure of human subjects to 800 ppm for 5 minutes caused irritation of the eyes and nose and some reported respiratory discomfort; exposure to 500 ppm for 15 minutes was not irritating but at 300 ppm one third of the subjects objected to the unpleasant odor. The liquid dropped in the eye of a rabbit caused minor injury. In rabbits, repeated skin exposure to the liquid for 10 days caused dermatitis, possibly due to defatting action.

III. SIGNS AND SYMPTOMS

Irritation of eyes, nose; respiratory discomfort; dermatitis; by analogy to effects caused in animals, it may cause signs of narcosis at high levels.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes with water and wash skin with soap or mild detergent and water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation and administer oxygen if indicated. Recovery is usually rapid and complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

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Most reported effects of isopropylether are caused by its irritant and narcotic properties. It is important that the physician become familiar with plant operating conditions in which exposure to isopropylether 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 examinations 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 isopropylether exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of isopropylether might cause exacerbation of symptoms due to its irritant properties.
2. Skin disease -- Isopropylether is a defatting agent and can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.

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.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Isopropyl Ether," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 327-328.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1661-1664.

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REFERENCES AND SOURCES

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1910.1000

- (d) Compliance - Open surface tank classification based on relative evaporation rate of 0.8 hours (from Doolittle)
- (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, "Industrial Hygiene and Toxicology;" Union Carbide Corp., "Toxicology Studies"
- Skin: Patty, "Industrial Hygiene and Toxicology;" Union Carbide Corp., "Toxicology Studies"
- Ingestion: Union Carbide Corporation, "Toxicology Studies;" Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Union Carbide reports "flooding the rabbit eye with an excess of the chemical caused a reaction no more severe than moderate inflammation."

According to Patty, "this compound is . . . capable of producing only minor injury to the eyes."

A classification of 2 is concluded to be sufficient for this compound.

Skin - Classification: 2

Output statement numbers: 2, 7b, 16i, 21

Exceptions: None

Patty reports "Machle et al. tested the effect of isopropylether on the skin of rabbits. Single exposures to the liquid for one hour produced no deleterious effect. However, repeated exposure for 10 days caused dermatitis. . . Skin absorption in deleterious amounts seems to be no problem. . ."

Union Carbide reports single skin penetration in rabbits to be of "slight hazard." The LD50 is in the vicinity of 20 ml/kg body weight. Union Carbide adds that skin irritation to the rabbit belly is a "slight hazard. The undiluted chemical caused no reaction on the tender skin of the rabbit belly greater than a faint redness of short duration."

The substance has a boiling point of 156 degrees F, a melting point of -121 degrees F and a vapor pressure at 20 degrees C of 119 mm Hg. It is 0.2% soluble in water and has a flash point of -18 degrees F.

A classification of 2 is concluded to be fully adequate for this compound.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Union Carbide gives an oral LD50 of 8.47 g/kg for the rat.

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Patty reports that "the minimum lethal dose for rabbits was found to be between 7 and 9 ml/kg (5 to 6.5 g/kg). A rapid, intense intoxication was produced. Death was due to respiratory failure caused by depressant action. . . it is probable that the major portion of a dose is eliminated through the lungs after cessation of exposure, and that the compound is not metabolized in vivo."

Considering the low oral toxicity and high vapor pressure of this compound, it is concluded that ingestion, in the context of this standard, would not present a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)

Shell Chemical Co., Technical Bulletin IC:69-29 and Material Safety Data Sheet (Shell)

Union Carbide Corp., "Chemicals and Plastics, Physical Properties," 1974 (UCC)

"Lange's Handbook of Chemistry," 11th edition (Lange)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-325M, NFPA-49
2. Formula: Shell
3. Molecular weight: Shell
- B. 1. Boiling point: NFPA-325M, Shell
2. Specific gravity: NFPA-325M
3. Vapor density: NFPA-325M
4. Melting point: UCC
5. Vapor pressure: Shell
6. Solubility in water: Lange
7. Evaporation rate: Shell
8. Appearance and odor: NFPA-49, Shell
- II. A. 1. Flash point: NFPA-325M, Shell
2. Autoignition temperature: NFPA-325M
3. Flammable limits: NFPA-325M, Shell
4. Extinguishing media: Shell
5. Special fire fighting procedures: NFPA-325M, NFPA-49
6. Unusual fire and explosion hazards: NFPA-49
- B. 1. Conditions contributing to instability: NFPA-49
2. Incompatibilities: NFPA-49, Shell
3. Hazardous decomposition products: None
4. Special precautions: ADL
- III. A. Steps if released or spilled: Shell
C. Waste disposal method: Shell, ADL
- V. Miscellaneous precautions: NFPA-49, Shell

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

American Conference of Governmental Industrial Hygienists, "Documentation of Threshold Limit Values," 1971 (TLV)

Browning, E., "Toxicity and Metabolism of Industrial Solvents," Elsevier, 1965 (Browning)

"Chemical Abstracts," 66 - 75, 1967 - 71 (CA)

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- Doolittle, A. K., "The Technology of Solvents and Plasticizers," Wiley, 1954 (Doolittle)
- "Ether Peroxides," U. S. Navy Medical Newsletter, 46(11), p. 27 - 8, 1965 (NIOSH Technical Information Service NIOSH 2530)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- "Isopropylether," Exxon Chemical Co., Material Safety Data Sheet, February 1972 (Exxon MSDS)
- "Isopropylether," Hazard Process Index, Hazard Entry No. 100, NIOSH-HSM-99-73-62 (HPI)
- "Isopropylether," Shell Chem. Co., Technical Bulletin IC:69 -29, Safety and Toxicity Data Sheet, May 1969 (Shell IC:69 - 29)
- "Isopropylether," Shell Chem. Co., Material Safety Data Sheet, October 1971 (Shell MSDS)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 1st edition, vol. 5, 1950 (Chem Tech); 2nd edition, vol. 8, 1965 (K-O)
- National Fire Codes, vol. 3, "Combustible Solids, Dusts and Explosives," NFPA 49, National Fire Protection Assoc., Boston, 1973 (NFPA 49)
- Patty, F. A., "Industrial Hygiene and Toxicology," vol. II, Interscience, 1962 (Patty)
- Steere, N. Y., "Control of Hazards from Peroxides in Ether," J. Chem. Ed., 41(8), A575 - A579, 1964 (NIOSH Technical Information Service NIOSH 11984)

References for Specific Use/Exposures

1. Chem Tech, K-O, HPI, Patty, Doolittle, ILO, Browning, CA
2. Chem Tech, K-O, HPI, Patty, Doolittle, ILO, Browning, CA
3. Doolittle, K-O, Browning
4. K-O, Doolittle
5. NIOSH 2530, HPI, K-O, NFPA (NIOSH 11984)
6. Patty, Browning, Chem Tech, CA
7. ILO, Chem Tech, K-O, Browning

References for Specific Control Methods

TLV, Exxon MSDS, Shell MSDS, Shell IC:69 - 29, K-O, ILO were the references used in all the Specific Control Methods.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Isopropylether

D. O. L. STANDARD: 500 ppm

WARNING PROPERTIES:

Odor Threshold: Patty states that 35% of human subjects exposed experimentally to isopropylether "objected to the unpleasant odor of this solvent at a vapor concentration of 300 ppm."

Irritation Level: Patty states that "Silverman et al. reported that humans exposed to a vapor concentration of 500 ppm isopropyl ether for 15 minutes while watching a movie noted no irritating properties . . . At 800 ppm for 5 minutes most subjects reported irritation of the eyes and nose, and the most sensitive reported respiratory discomfort."

For the purposes of this standard, only full facepiece respirators are permitted.

Evaluation of Warning Properties: Through its odor and irritant effects, isopropylether can be detected at or slightly above the permissible exposure limit. For the purposes of this standard, therefore,

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isopropylether is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 10,000 ppm

Basis for IDLH Value: The chosen IDLH is based upon the information given in the Chemical Company Guide of Union Carbide Corporation for isopropylether, which states that "breathing the vapors in a state approaching saturation in room air killed all animals (rats) in a ten minute exposure. Breathing a known concentration of 8,000 parts per million was not fatal after a four-hour exposure but double this concentration killed all of six animals exposed for the same period of time."

Other Toxicological Information: According to the Documentation of TLV's, "isopropylether has an anesthetic action very much like ethyl ether but is somewhat more toxic. The odor is also more irritating and less pleasant than that of ethyl ether. Animal exposure studies conducted by Machle et al. showed no toxic effects other than narcosis and death at very high concentrations. Animals exposed (20 exposures) repeatedly at a vapor concentration of 1% exhibited intoxication and depression but revealed no significant blood or weight changes. Twenty exposures at 0.1%, three hours daily produced no deleterious effects. The minimum lethal dose for rabbits was 5 to 6.5 g/kg. Liquid isopropylether is irritating to the mucous membranes and repeated exposure to the skin of rabbits caused dermatitis.

"In the only human experience reported, Silverman et al. stated that a group of persons exposed for 15 minutes at 200 ppm did not consider the exposure to be irritating. At a concentration of 300 ppm, however, about a third of the subjects objected to the unpleasant odor, while at 800 ppm for five minutes most subjects reported irritation of the eyes and nose.

"On the basis of these limited human observations, a TLV of 250 ppm is recommended to prevent mild irritation of unpleasant odor."

The ILO states that "the principal physiological response on exposure to excessive concentrations is anaesthesia. A single exposure to rats of 1.6% for 4 hours caused death. Ten exposures of animals to 3.0% caused some weight loss and blood changes that persisted for several weeks after the exposure. A single exposure of 0.3% for 2 hours caused no noticeable anaesthesia in experimental animals, nor were any deleterious effects noted after 20 such exposures."

Patty reports that "Machle et al. exposed animals (monkey, rabbit, and guinea pig) to a vapor concentration of 6.0 per cent of isopropylether in air. All died due to respiratory failure. At a vapor concentration of 0.3 per cent for 2 hours there was no visible indication of anesthetic action. Smyth found the lethal vapor concentration for rats to be 1.6 per cent for a 4-hour exposure."

-LFL: 14,000 ppm

VAPOR PRESSURE AT 20 C: 119 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 157,000 ppm

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	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use as extraction solvent (recovery of acetic and lactic acids; extraction of nicotine from tobacco; dewaxing of petroleum oils) and for azeotropic distillation	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)
2.	Inhalation of vapor and skin contact with liquid during use as solvent for rubber adhesives; lacquers; resins (in paint and varnish removers); animal, vegetable, and mineral oils and waxes; ethyl cellulose and other synthetic fibers	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)
3.	Inhalation of vapor and skin contact with liquid during use as solvent in manufacture of pharmaceuticals and smokeless gunpowder	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)
4.	Inhalation of vapor and skin contact with liquid during use as solvent in textile spot cleaning	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)
5.	Inhalation of vapor and skin contact with liquid during manufacture, distribution, and maintenance of equipment	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing) process enclosure
6.	Inhalation of vapor and skin contact with liquid during use in organic synthesis: alkylating agent; preparation of	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves,

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emulsion breakers for use
in the petroleum industry;
preparation of polymeri-
zation catalysts

goggles, protective clothing)
process enclosure

7. Inhalation of vapor and skin contact with liquid during limited use as a blending agent for gasoline (increases octane rating) and as fuel in internal combustion engines
- A, B
- Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)

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