

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** ISOPROPYLAMINE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ISOPROPYLAMINE

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 ISOPROPYLAMINE.

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 isopropylamine not in excess of 5 parts per million (ppm) (12 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 isopropylamine.

(b) Exposure determination and measurement. (1) Each employer who has a place of employment in which isopropylamine is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of isopropylamine 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 isopropylamine.

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

(i) Any information, observations, or calculation which may indicate employee exposure to isopropylamine;

(ii) Any measurements of isopropylamine taken;

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

(iv) Date of determination, work being performed at the time, location within work site, name, and social security number of each employee considered.

(3) If the employer determines that any employee may be exposed to isopropylamine at or above the action level, 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 isopropylamine 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.

(5) If an employee exposure measurement reveals that an employee is exposed to isopropylamine 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.

(6) If an employee exposure measurement reveals that an employee is exposed to isopropylamine 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 isopropylamine above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to isopropylamine 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
Above permissible exposure	\pm 25%
At or below permissible exposure and above the action level	\pm 35%
At or below the action level	\pm 50%

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

(2) Employee exposures to airborne concentrations of isopropylamine 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 technically 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 mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, 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 isopropylamine.

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

(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 technically not feasible; or
 - (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of isopropylamine 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 ISOPROPYLAMINE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration 250 ppm or less	A chemical cartridge respirator with a full facepiece and a cartridge(s) providing protection against isopropylamine. ----- A gas mask with a chin-style or a front- or back-mounted canister which provides protection against isopropylamine. ----- Any supplied-air respirator with a full facepiece, helmet or hood. ----- Any self-contained breathing apparatus with a full facepiece.
4000 ppm or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet or hood operated in continuous-flow mode.
Greater than 4000 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

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breathing apparatus operated in pressure-demand or other positive pressure mode. (Supplied-air suits may be necessary.)

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 isopropylamine.

Any escape self-contained breathing apparatus.

(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 isopropylamine.

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

(3) For the purpose of compliance with § 1910.157, isopropylamine 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 isopropylamine shall be Class I, Group D.

(5) For the purpose of compliance with § 1910.106, liquid isopropylamine is classified as a Class IA 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 isopropylamine is present in the ductwork in concentrations greater than 5000 ppm (approximately 25 percent 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 isopropylamine is used, handled or stored.

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

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary

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to prevent skin contact with liquid isopropylamine, where skin contact may occur. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

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

(3) Where exposure of an employee's body to liquid isopropylamine may occur, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(4) Employers shall ensure that any clothing which becomes wet with or non-impervious clothing which becomes contaminated with isopropylamine be removed immediately and not reworn until the isopropylamine is removed from the clothing.

(5) Employers shall provide and ensure that employees use splash-proof safety goggles (cup-cover type dust and splash safety goggles) which comply with § 1910.133 (a)(2)-(a)(6) where there is any possibility of liquid isopropylamine contacting the eyes.

(6) Where there is any possibility that an employee's eyes may be exposed to liquid isopropylamine, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

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

(2) Liquid isopropylamine shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

(h) Sanitation. Employers shall ensure that employees whose skin becomes wet with liquid isopropylamine immediately wash or shower to remove any isopropylamine from the skin.

(i) Training and information. (1) Each employer who has a workplace in which isopropylamine 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 isopropylamine above the action level or employees who may have skin or eye contact with liquid isopropylamine, or employees who work where isopropylamine presents a fire or explosion hazard, shall annually:

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to isopropylamine 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

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

(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) The employer shall obtain from each employee who is exposed, or will be exposed, to liquid isopropylamine or airborne concentrations of isopropylamine at or above the action level, information as to whether such employee has a history of any of the following medical conditions:

- (i) Chronic lung disease
- (ii) Skin disease
- (iii) Eye 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 isopropylamine which are listed in Appendix A which the employee suspects are caused by exposure to isopropylamine.

(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 isopropylamine;

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

(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 shall be a signed statement by the examining physician specifically stating: (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 isopropylamine or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to isopropylamine 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 exposure to isopropylamine.

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

(7) No employee shall be exposed to liquid isopropylamine or airborne concentrations of isopropylamine in such a way as would put the employee at increased risk of material impairment of his health from such exposure. This determination may be based on the physician's written opinion.

(8) The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to isopropylamine.

(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.

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

(ii) This record shall include:

(A) The date of measurement;

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

(C) Sampling and analytical methods used and evidence of their accuracy, including the method, results and date of calibration of sampling equipment;

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

(E) 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 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 and social security number of employee trained;

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- (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) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;
- (B) Any employee medical complaints relative to exposure to isopropylamine;
- (C) A copy of information provided to the physician pursuant to paragraph (j)(4)(ii), (iii), (iv), (v), and (vi) of this section.
- (D) Physician's written opinion; and
- (E) A signed statement of any refusal to be examined.
- (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.
- (ii) Employee exposure determination and 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.
- (1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to isopropylamine which is conducted pursuant to this section.
- (2) When observation of measurement of employee exposure to isopropylamine 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 isopropylamine that are being performed at the place of exposure; and
- (iii) Record the results obtained.

NOTE: The information contained in the following appendixes is advisory in nature and is not intended, by itself, to create any additional obligations not otherwise imposed or detract from any existing obligation.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR ISOPROPYLAMINE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Isopropylamine
- B. Permissible Exposure: 5 parts of isopropylamine per million parts of air (ppm) (12 milligrams of isopropylamine per cubic meter of air, (mg/m³)) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid with a pungent odor, like ammonia.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Isopropylamine can affect your body if you inhale it, if it comes in contact with your eyes or skin, or if you swallow it. It may enter your body through your skin.
- B. Effects of Overexposure:
 - 1. Short-Term Exposure: Isopropylamine vapor may cause irritation of the nose, throat and lungs. Both isopropylamine liquid and vapor may cause irritation or burning of the eyes and skin. Permanent eye damage may occur if proper care is not given immediately. Breathing difficulties may occur either immediately or may be delayed.
 - 2. Long-Term Exposure: Repeated or prolonged exposure to isopropylamine causes an irritation of the skin.
 - 3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to isopropylamine.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If isopropylamine gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If isopropylamine gets on your skin, immediately flush the contaminated skin with water. If isopropylamine soaks through your clothing remove the clothing immediately and flush the skin with water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of isopropylamine 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 isopropylamine has been swallowed, give the person large quantities of water immediately. After the

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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 equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to isopropylamine. 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 (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 there use is required. If you can smell isopropylamine 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. Supplied-air suits: In some work situations the wearing of supplied-air suits may be necessary. Your employer should instruct you in their proper use and operation.
- C. Protective Clothing: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent skin contact with liquid isopropylamine, where skin contact may occur. Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles where there is any possibility of liquid isopropylamine contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Isopropylamine is a flammable liquid and its vapors can easily form explosive mixtures with air.
- B. Isopropylamine must be stored in tightly closed containers, in a cool, well ventilated area away from heat, sparks, flames, strong oxidizers, and strong acids.
- C. Sources of ignition such as smoking and open flames are prohibited wherever isopropylamine is handled, used or stored.
- D. You must use non-sparking tools when opening or closing metal containers of isopropylamine, and containers must be bonded and grounded when pouring or transferring liquid isopropylamine.

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- E. You must immediately remove any non-impervious clothing that becomes contaminated with isopropylamine and this clothing must not be re worn until the isopropylamine is removed from the clothing.
- F. Clothing wet with liquid isopropylamine can be easily ignited. You must immediately remove this clothing and it must not be re worn until the isopropylamine is removed from the clothing.
- G. If your skin becomes wet with liquid isopropylamine, you must immediately wash or shower to remove the isopropylamine from your skin.
- H. Fire extinguishers, eye flushing facilities and quick drenching facilities, where provided, must be readily available and you should know where they are and how to operate them.
- I. Ask your supervisor where isopropylamine is used in your work area and for any additional plant 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 isopropylamine. In addition, your employer must instruct you in the safe use of isopropylamine, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to isopropylamine. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR ISOPROPYLAMINE

I. PHYSICAL AND CHEMICAL DATA

- A. Substance Identification
 - 1. Synonyms: Monoisopropylamine; 2-aminopropane
 - 2. Formula: $(CH_3)_2CHNH_2$

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3. Molecular weight: 59.1

B. Physical Data

1. Boiling point (760 mm Hg): 32.4 C (90 F)
2. Specific gravity (water = 1): 0.68
3. Vapor density (air = 1 at boiling point of isopropylamine): 2.03
4. Melting point: -95 C (-139 F)
5. Vapor pressure at 20 C (68 F): 478 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate = 1): Greater than 1
8. Appearance and odor: Colorless liquid with a pungent, ammonia-like odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: -37 C (-35 F) (closed cup)
2. Autoignition temperature: 402 C (756 F)
3. Flammable limits in air, % by volume: Lower: 2.0; Upper: 10.4
4. Extinguishing media: Alcohol foam, carbon dioxide, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Isopropylamine is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where isopropylamine is handled, used or stored. Isopropylamine 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 isopropylamine is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, isopropylamine is classified as a Class IA flammable liquid. For example, 5000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which isopropylamine 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 isopropylamine shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact of liquid with strong acids will cause explosive spattering. Contact with strong oxidizers may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen and carbon monoxide) may be released in a fire involving isopropylamine.

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4. Special precautions: Liquid isopropylamine will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isopropylamine is spilled or leaked, the following steps should be taken:
1. Remove all ignition sources.
 2. Ventilate area of spill or leak.
 3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for vapors to completely clear hood ductwork, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Isopropylamine may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Isopropylamine may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

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 eight-hour sample or two (2) 4-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 analyses. The method of measurement must determine the concentration of isopropylamine 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 isopropylamine 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 K" (Order number XXXXXXXXXXX).

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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 isopropylamine in tightly closed containers in a cool, well ventilated area.
- B. High exposures to isopropylamine can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal isopropylamine containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Use of supplied-air suits or other impervious coverings may be necessary to prevent skin contact with isopropylamine where the concentration of isopropylamine is unknown or is greater than 4000 ppm. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits.
- E. Employers should advise employees of all areas and operations where exposure to isopropylamine could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to isopropylamine is likely to occur are: during its production and its use in the synthesis of herbicides and in solubilizing herbicides; in the purification of penicillin; as a stabilizer for vinylidene chloride monomer; as an intermediate in the synthesis of floor polishes, dry cleaning soaps, ore flotation agents, dyes, insecticides and bactericides, and vulcanization accelerators; as a solvent; and as a depilatory in leather manufacture.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Isopropylamine vapor is a respiratory and eye irritant. Rats exposed to 8000 ppm for 4 hours died as a result of pulmonary edema. Human subjects experienced irritation of the nose and throat after brief exposures to 10 to 20 ppm. Workers complained of transient visual disturbances after exposure to the vapor for 8 hours, probably due to mild corneal edema which usually cleared within 3 or 4 hours. The liquid is capable of causing very severe eye burns which may cause permanent visual impairment. Isopropylamine in both liquid and vapor forms is irritating

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to the skin and may cause skin burns; repeated lesser exposures may result in dermatitis.

III. SIGNS AND SYMPTOMS

Irritation of the eyes, nose, throat and skin; at high levels of exposure may cause pulmonary edema; impaired vision; skin and eye burns; dermatitis from repeated exposure.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Immediately flush eyes and skin with water. If swallowed and the person is conscious, immediately administer water by mouth and induce vomiting. Give artificial resuscitation if indicated. Recovery is usually complete. Observe for delayed onset of pulmonary edema.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

At high doses in animals, isopropylamine is a respiratory and eye irritant. It is important that the physician become familiar with plant operating conditions in which exposure to isopropylamine 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 isopropylamine exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Chronic respiratory disease -- Isopropylamine causes respiratory irritation in animals. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of isopropylamine might cause exacerbation of symptoms due to its irritant properties.
2. Eye disease -- Isopropylamine is an eye irritant and has caused corneal edema in workers. Persons with preexisting eye disorders may be more susceptible to the effects of this agent.

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3. Skin disease -- Isopropylamine is a primary skin irritant. 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: "Isopropylamine," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 141-142.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 2038, 2040, 2044, 2045, 2053, 2054.
3. Manufacturing Chemists Association, Inc.: Chemical Safety Data Sheet SD-72, Isopropylamine, Washington, D.C., 1959, pp. 13-15.

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REFERENCES AND SOURCES
ISOPROPYLAMINE
1910.93

- (d) Compliance - Open surface tank classification based on boiling point and guidelines in ANSI Z9.1.
- (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, (primary amin
- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Grant, "Toxicology of the Eye;" "Isopropylamine," Manufacturing Chemists' Association
- Skin: "Isopropylamine," Manufacturing Chemists' Association; "Isopropylamine," Union Carbide Corporation; Patty, "Industrial Hygiene and Toxicology"
- Ingestion: "Isopropylamine," Union Carbide Corporation; "Isopropylamine," Manufacturing Chemists' Association; Patty, "Industrial Hygiene and Toxicology;" Grant, "Toxicology of the Eye"

COMMENTS

Eye - Classification: 1

Output statement numbers: 9, 13

Exceptions: None

According to Grant, isopropylamine tested on rabbit eyes caused serious injury, graded 10 on a scale of 10 after 24 hours. On the scale referred to, this indicates that an excess of 1% solution can cause severe eye injury in 24 hours. Manufacturing Chemists' Association notes "liquid isopropylamine produces typical alkali burns." Under this Grant includes symptoms of "sloughing of the corneal epithelium, necrosis of the cells of the corneal stroma and endothelium, loss of corneal mucoid and edema of the corneal stroma and conjunctiva." A classification of 1 is clearly warranted.

Skin - Classification: 2

Output statement numbers: 2, 7b, 8b, 14g and 21 combined, 14i.

Exceptions: See below

The Manufacturing Chemists' Association notes "repeated exposure of the skin to liquid isopropylamine may result in dermatitis . . . (though) sensitization is rare." They continue, "isopropylamine causes burns similar to those of strong solutions of ammonia." Union Carbide lists a rabbit skin penetration LD50 of 0.55 ml/kg and notes "this result suggests the chemical penetrates the skin in harmful amounts." They also report "the undiluted chemical caused burns and blister formation on the tender skin of the rabbit belly." According to Patty, rabbit skin irritation was graded 6 representing "necrosis from undiluted, less than edema from 10%." For a 40% solution, Patty reports a guinea pig skin penetration LD50 of 0.5 ml/kg. The vapor pressure of this substance is 478 mm Hg at 20 C. It is miscible in all proportions with

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water and has a flashpoint of -23 C. The corrosiveness and low skin absorption LD50 of the substance indicate that a classification of 2 is appropriate if statement 2 is written to prevent contact where such contact "may occur," and statements 14 are used instead of statements 16 or 17. Statement 14i modified as skin only slightly contaminated with isopropylamine would be dry before it could be washed. Statement 20a is not necessary because of the considerable vapor pressure of the substance.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

The Manufacturing Chemists' Association notes that chronic exposure "caused no systemic effects in routine industrial handling." Union Carbide reports an oral rat LD50 of less than 0.1 g/kg. The considerable vapor pressure of the substance leads to the conclusion that ingestion would not be a problem in industry.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

- Manufacturing Chemists' Association, Chemical Safety Data Sheet SD-72 (MCA)
- National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)
- Air Products and Chemicals, Inc., Product Data Sheet and Material Safety Data Sheet (Air)
- Factory Mutual System, "Fire Protection Handbook," 3rd edition (FM)

Sources of data items used:

- I. A. 1. Synonyms: MCA
- 2. Formula: MCA; Air
- 3. Molecular weight: ADL
- B. 1. Boiling point: MCA
- 2. Specific gravity: NFPA-325M; MCA
- 3. Vapor density: NFPA-325M; MCA
- 4. Melting point: MCA
- 5. Vapor pressure: Air
- 6. Solubility in water: Air
- 7. Evaporation rate: Air
- 8. Appearance and odor: MCA; Air
- II. A. 1. Flash point: NFPA 325 M
- 2. Autoignition temperature: MCA; NFPA-325M
- 3. Flammable limits: FM
- 4. Extinguishing media: MCA; NFPA-325M; Air
- 5. Special fire fighting procedures: MCA; Air
- 6. Unusual fire and explosion hazards: MCA; ADL
- B. 1. Conditions contributing to instability: ADL
- 2. Incompatibilities: Air
- 3. Hazardous decomposition products: ADL
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: MCA; ADL
- C. Waste disposal method: MCA; Air
- V. Miscellaneous precautions: ADL

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USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of this document include:

- "Amines, Alkyl and Alkylene," Product Bulletin, Union Carbide Chemicals Company, 1959 (Union Carbide)
- Faith, W. L., Keys, D. P. and Clark, R. L., "Industrial Chemicals," John Wiley and Sons, 3rd edition, 1965 (Faith)
- Hahn, A. V. G., "The Petrochemical Industry - Markets and Economics," McGraw-Hill Book Company, New York, 1970 (Hahn)
- Hawley, G. G. - editor, "The Condensed Chemical Dictionary," Van Nostrand Reinhold Company, 8th edition, 1971 (Hawley)
- "Isopropylamine," Data Sheet, Air Products and Chemicals Corporation, Wayne, Pa., 1971 (Air Products)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 1st edition, 1954 (Chem Tech)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 2nd edition, 1968 (K-O)
- "Merck Index of Chemicals and Drugs," Merck and Company, Rahway, New Jersey, 8th edition, 1968 (Merck)
- Plunkett, E. R., "Handbook of Industrial Toxicology," Chemical Publishing Company, Inc., 1966 (Plunkett)
- Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

References for Specific Use/Exposure

1. SRI, Faith, Hahn
2. K-O, Hawley, Faith, Union Carbide, Air Products
3. Hawley, Plunkett
4. K-O, Hawley, Faith, Hahn, Union Carbide, Air Products
5. Hawley, Faith, Hahn, Union Carbide, Plunkett
6. Hawley, Hahn
7. Air Products
8. Hawley, Chem Tech
9. Air Products
10. Hawley
11. Air Products
12. SRI, K-O, Air Products, Plunkett
13. Hawley, Plunkett

References for Specific Control Methods

Merck, Hawley, Air Products and Plunkett were the references used in numbers 1 - 13.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Isopropylamine

D. O. L. STANDARD: 5 ppm

WARNING PROPERTIES:

Odor Threshold: Patty reports that at a concentration of 5 to 10 ppm isopropylamine, the ammoniacal odor is definite, and at 10 to 20 ppm, the odor is strong.

Eye Irritation Level: The Manufacturing Chemists' Association's Chemical Safety Data Sheet for isopropylamine notes that the vapors of isopropylamine are highly irritating to the eyes, but no quantitative information is available concerning the

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threshold of eye irritation.

Other Information: Patty reports that nose and throat irritation result from short exposures to 10 to 20 ppm isopropylamine. No eye irritation is cited.

Evaluation of Warning Properties: Since the odor of isopropylamine is definite at a concentration which is only 2 times the permissible exposure, and since nose and throat irritation occur at a concentration which is only 2 to 4 times the permissible exposure, isopropylamine is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 4000 ppm

Basis for IDLH Value: This IDLH (4000 ppm) is based upon the report in the Documentation of TLV's that a 4-hour exposure to 4000 ppm isopropylamine killed no rats out of 6 and a 4-hour exposure to 8000 ppm killed 6 out of 6 rats. Since a concentration of 8000 ppm is obviously too high to be the IDLH, 4000 ppm has been chosen to be the IDLH concentration, since no other quantitative information upon which to base the IDLH is available.

Other Toxicological Information: The Documentation of TLV's reports that Smyth found that rats survived a 4-hour exposure to 4000 ppm, but all rats died from a 4-hour exposure to 8000 ppm. "Smyth suggested that the most important effect from inhalation was respiratory tract irritation, with lung edema the maximal injury."

The Manufacturing Chemists' Association's Chemical Safety Data Sheet for isopropylamine states that "no systemic effects have been noted in routine industrial handling" of isopropylamine. The vapor is highly irritating to the skin, eyes, and lungs, however.

Union Carbide Corporation's Chemical Company Guides report a single skin penetration LD50 in rabbits of 0.55 ml/kg for isopropylamine.

LEL: 23,000 ppm

VAPOR PRESSURE: 478 mm Hg at 20 deg. C.

SATURATED CONCENTRATION AT 20 DEG. C.: 629,000 ppm

NOTE: Since all organic vapor cartridges may not be efficient in removing isopropylamine only those cartridges and canisters which provide protection against isopropylamine are permitted.

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Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid when isopropylamine is used as an intermediate in the synthesis of agricultural chemicals such as the herbicides "propazine" (sugar and corn weeds) and "avadox" (wild oats)	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)
2. Inhalation of vapor and skin contact with liquid when isopropylamine is used as a solubilizer for 2,4-D and 2,4,5-T herbicides in hard water	A,B,D	Local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)
3. Inhalation of vapor and skin contact with liquid when used as an intermediate in the synthesis of insecticides and bactericides	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)
4. Inhalation of vapor and skin contact with liquid when combined with a surface-active sulfonate such as dodecylbenzene sulfonic acid. The resulting salt is an excellent oil soluble emulsifier and detergent used in dry cleaning operations.	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)
5. Inhalation of vapor and skin contact with liquid when isopropylamine is used as an intermediate in the synthesis of vulcanization accelerators for sulfur-cured rubbers	A,B,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)
6. Inhalation of vapor and skin contact with liquid	A,B,D	General dilution ventilation; local exhaust ven-

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during manufacture of isopropylamine and during maintenance of manufacturing and storage equipment. Isopropylamine is manufactured from either isopropyl chloride and ammonia or isopropyl alcohol and ammonia.

tilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles)

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|-----|---|---------|--|
| 7. | Inhalation of vapor and skin contact with liquid when isopropylamine is used in the manufacture of ore flotation agents | A, B, D | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 8. | Inhalation of vapor and skin contact with liquid when isopropylamine is used as a depilatory on skins and hides in leather manufacture | A, B, D | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 9. | Inhalation of vapor and skin contact with liquid when isopropylamine is used in manufacturing emulsion-type flour polishes | A, B, D | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 10. | Inhalation of vapor and skin contact with liquid when used as a general solvent | A, B, D | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 11. | Inhalation of vapor and skin contact with liquid when isopropylamine is used as a stabilizer (against oxidation and polymerization) for vinylidene chloride | A, B, D | Local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
| 12. | Inhalation of vapor and skin contact with liquid when used as an intermediate in the manufacture of medicinals such as the hormone isoproterenol | A, B, D | Local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |

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and when used in the
purification of penicillin
and streptomycin

- | | | | |
|-----|---|-------|--|
| 13. | Inhalation of vapor and skin contact with liquid when used as an intermediate in the synthesis of some dyes | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons, goggles) |
|-----|---|-------|--|

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