

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** ISOAMYL ALCOHOL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ISOAMYL ALCOHOL

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 ISOAMYL ALCOHOL.

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

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

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(a) DEFINITIONS

- (1) PERMISSIBLE EXPOSURE - "Permissible Exposure" means inhalation of isoamyl alcohol in concentrations not in excess of 100 parts per million (ppm) (360 milligrams per cubic meter, mg/cu.m.) averaged over an eight hour work shift, as stated in section 1910.93, Table G-1.
- (2) ACTION LEVEL - "Action Level" means one half (1/2) of the permissible exposure for isoamyl alcohol.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which isoamyl alcohol is present shall:

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

(c) EXPOSURE MEASUREMENT

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

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

Table 1

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

(e) Methods of Compliance

- (1) Engineering controls - No employee shall be exposed to isoamyl alcohol above the permissible limit as defined in paragraph (a)(1) of this section. Engineering and work practice controls shall be used to reduce exposure to isoamyl alcohol to at or below the permissible exposure.
- (i) When mechanical ventilation is used to control exposure, measurements which demonstrate system efficiency (for example: air velocity, static pressure, or air volume) shall be made at least every three months. Measurements of system efficiency shall also be made within five work days of any change in production, process or control which might result in a reduction in control.
 - (ii) In the design of open surface tank ventilation for the purposes of section 1910.94 (d), operations involving isoamyl alcohol shall be classified as B-3 at 70 F.
 - (iii) Where a fan is located in duct work and where isoamyl alcohol is present in concentrations greater than 3000 ppm, one fourth of the lower flammable limit, the fan rotating element shall be of nonsparking material or the casing shall consist of, or be lined with, non-sparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(2) Respirators

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- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:
 - (a) During the time period necessary to install engineering controls; or
 - (b) In work situations in which engineering controls are technically not feasible; or
 - (c) In work situations in which feasible engineering and work practice controls are insufficient to reduce employees exposure to at or below the permissible exposure. Where technically feasible engineering and work practice controls are not sufficient to reduce exposure to at or below permissible exposure, they shall be used to reduce exposure to the lowest level feasible; or
 - (d) For operations not exceeding 40 hours per year; or
 - (e) In emergencies.
- (ii) Respirators shall be jointly approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) and by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.
- (iii) Employers shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.
- (iv) Employers shall institute a respiratory protection program in accordance with sections 1910.134(b),(d),(e) and (f).

TABLE 2. RESPIRATORY PROTECTION FOR ISOAMYL ALCOHOL

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 1000 ppm	A chemical cartridge respirator with full facepiece and organic vapor cartridge(s).
Equal to or less than 5000 ppm	A gas mask with a chin-style or 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.
Equal to or less than 10 000 ppm	A Type C supplied-air respirator with full facepiece operated in pressure-demand (positive pressure) mode or with a full facepiece, helmet or hood operated in continuous-flow mode.

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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- auxiliary self-contained air supply operated in pressure- demand mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.
Escape	Any gas mask providing protection against organic vapors. Any escape self-contained breathing apparatus.

(f) Fire and Safety

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

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of isoamyl alcohol shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, isoamyl alcohol is classified as a Class B fire hazard.
- (3) Powered industrial trucks - For the purposes of compliance with section 1910.178, locations classified as hazardous locations due to the presence of isoamyl alcohol shall be Class I Group D.
- (4) Combustible liquids - For the purposes of compliance with section 1910.106, liquid isoamyl alcohol is classified as a Class II combustible liquid. Spray finishing operations shall be performed in accordance with sections 1910.107 and 1910.94(c). Dip tank operations shall be performed in accordance with sections 1910.108 and 1910.94(d).
- (5) Sources of ignition - Sources of ignition such as smoking or open flames are prohibited where isoamyl alcohol is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - Isoamyl alcohol shall be stored so as not to come in contact with strong oxidizers.

(g) Personal Protective Equipment

(1) Skin Contact

- (i) Employers shall provide, and require employees to use, impervious clothing, gloves, face shields (8 inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact to liquid isoamyl alcohol. Face shields shall comply with section 1910.133(a)(6).

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- (ii) Employers shall ensure that non-impervious clothing which becomes wet with liquid isoamyl alcohol be removed promptly and not reworn until the isoamyl alcohol is removed from the clothing.
- (iii) Employers shall ensure that clothing wet with liquid isoamyl alcohol is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of isoamyl alcohol from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the isoamyl alcohol, the employer shall inform the person performing the operation of the hazardous properties of isoamyl alcohol.
- (2) Eye Contact
 - (i) Employers shall provide, and require employees to use, splash-proof safety goggles (cup-cover type dust and splash safety goggles), which comply with section 1910.133(a)(6), where eye contact to liquid isoamyl alcohol may occur.
- (h) Spills
 - (1) Spills of isoamyl alcohol shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
 - (2) Liquid isoamyl alcohol may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
- (i) Sanitation
 - (1) Employers shall ensure that employees whose skin becomes wet with liquid isoamyl alcohol promptly wash or shower as necessary to remove any isoamyl alcohol from the skin.
 - (2) Employers shall ensure that employees who handle isoamyl alcohol wash their hands thoroughly with soap or mild detergent and water before eating or smoking.
- (j) Training and Information - Each employer who has employees exposed to isoamyl alcohol in excess of the action level, or employees who may have skin or eye contact with liquid isoamyl alcohol, or employees who work where accidental release, spill, fire, or explosion of isoamyl alcohol may occur, shall annually:
 - (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for isoamyl alcohol, which is contained in Appendix A; and
 - (2) Medical -
 - (I) Advise employees as to the signs and symptoms of exposure to isoamyl alcohol.
 - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to isoamyl alcohol which are listed in Appendix A.
 - (III) Instruct the employees to inform the employer if they develop any of the medical conditions listed in (k)(2) of this section; and
- (3) Procedures -
 - (I) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to isoamyl alcohol.

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- (II) The procedures required by (j)(1), (2), and (3)(I) shall be provided to employees at the expense of the employer during the employee's normal working hours.

(k) Medical Surveillance

- (1) The employer shall provide medical procedures as required by paragraph (k). These procedures shall be provided at no cost to the employee.
- (2) Preplacement Questionnaire - The employer shall obtain from each employee who will be exposed to liquid isoamyl alcohol, or airborne concentrations of isoamyl alcohol at or above the action level, a written statement as to whether such employee has a history of any of the following:
 - (I) Skin disease
 - (II) Liver disease
 - (III) Kidney disease
 - (IV) Chronic lung disease
- (3) Preplacement Medical Examination - The employer shall provide a medical examination for an employee if the employee provides a history of any of the conditions named in paragraph (k)(2).
- (4) Results of Preplacement Examination - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(3).
- (5) Periodic Medical Examinations - The employer shall provide a medical examination for an employee if the employee advises the employer of the development of:
 - (I) Any of the medical conditions listed in (k)(2)
 - (II) Signs and symptoms listed in Appendix A which the employee suspects may be caused by exposure to isoamyl alcohol.
- (6) Results of Periodic Examinations - The employer shall obtain a physician's written opinion based on the medical examination pursuant to paragraph (k)(5).
- (7) Exclusion or Removal from Exposure - No employee shall continue to be exposed to isoamyl alcohol if such exposure could place the employee at increased risk of material impairment of his health.
- (8) Emergency Procedures - The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to isoamyl alcohol.
- (9) Informing the Physician - The employer shall provide to the examining physician the following information:

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- (I) A copy of this section with its Appendices A, B and C for isoamyl alcohol;
- (II) A description of the employee's duties as they relate to his exposure to isoamyl alcohol;
- (III) A description of any personal protective equipment, including respirators, required to be used;
- (IV) The results of any employee's exposure measurement, if available;
- (V) The employee's anticipated exposure level; and
- (VI) Upon request of the physician, information from previous medical examination of the employee.

(10) Physician's Written Opinion

- (I) The physician's written opinion shall be a signed statement by the examining physician specifically stating:
 - (A) Whether the employee has any detected medical conditions which could be directly or indirectly aggravated by exposure to isoamyl alcohol or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.
 - (B) Any recommended limitations upon the employee's exposure to isoamyl alcohol.
 - (C) The employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.
- (II) The written opinion shall not reveal medical information unrelated to exposure to isoamyl alcohol.

- (11) Refusal to be Medically Examined - If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.

- (12) 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.

(1) Recordkeeping.

(1) Initial determination.

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

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

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

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET

I. SUBSTANCE IDENTIFICATION

SUBSTANCE: Isoamyl alcohol

PERMISSIBLE EXPOSURE: 100 parts of isoamyl alcohol vapor per million parts of air (ppm) or 360 milligrams of isoamyl alcohol vapor per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with an alcoholic odor that causes coughing.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Isoamyl alcohol can affect your body if it is swallowed, inhaled, or if it comes in contact with your skin or eyes.

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to isoamyl alcohol may cause irritation of the eyes, and respiratory tract, headaches and dizziness, shortness of breath, cough, nausea, vomiting and diarrhea. Double vision, deafness, delirium, and death may occur. Coma, sugar in the urine, and blood changes have also been reported.
2. Long-Term Overexposure: Drying and cracking of the skin may result from prolonged or repeated skin exposure.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with isoamyl alcohol exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If isoamyl alcohol gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention as soon as possible. Contact lenses should not be worn when working with this chemical.

B. Skin Exposure: If isoamyl alcohol gets on your skin, flush the contaminated skin with water promptly. If isoamyl alcohol soaks through your clothing, remove the clothing promptly and flush the skin with water. Do not rewear the clothing until the isoamyl alcohol has been removed. Replace or repair impervious clothing that has developed leaks. If there is skin irritation get medical attention.

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- C. Breathing: If you or any other person breathes in large amounts of isoamyl alcohol remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When isoamyl alcohol has been swallowed get medical attention immediately. If medical attention is not immediately available get the affected person to vomit by having him touch the back of the throat with his finger or by giving him large amounts (one pint or more) of warm salt water (two tablespoons of salt per pint of water). Do not make an unconscious person vomit.
- E. Rescue: Move affected person from the hazardous exposure. If the exposed person has been overcome, notify someone else and put into effect the established emergency rescue procedures. Do not become a casualty yourself. Understand your emergency rescue procedures and know the locations of the equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. RESPIRATORS: Respirators are not the best way to control exposure to isoamyl alcohol. You can only be required to wear them for routine use if your employer is in the process of installing controls or other control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA)/National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) If you can smell isoamyl alcohol while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. PROTECTIVE CLOTHING: You must wear impervious clothing, gloves, face shields, and other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid isoamyl alcohol.
- C. EYE PROTECTION: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) if there is any possibility of liquid isoamyl alcohol contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Isoamyl alcohol is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures. It must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames, and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever isoamyl alcohol is handled, used or stored in a manner that could create a potential fire or explosion hazard. You must use non-sparking tools when opening or closing metal containers of isoamyl alcohol, and containers must be bonded and grounded when pouring or transferring liquid isoamyl alcohol. If your skin becomes wet with liquid isoamyl alcohol, you must promptly wash or shower as necessary to remove the isoamyl alcohol from your skin. You must promptly remove any non-impervious clothing that becomes wet with liquid isoamyl alcohol and this clothing must not be reworn until the isoamyl alcohol is removed from the clothing. If you handle liquid isoamyl

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alcohol, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities. Fire extinguishers and eye flushing facilities, where provided, must be readily available and you should know where they are and how to operate them. Ask your supervisor where isoamyl alcohol is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
ISOAMYL ALCOHOL

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: 3-methyl-1-butanol; isobutylcarbinol; isopentyl alcohol; fermentation amyl alcohol; fusel oil
 - 2. Formula: $(CH_3)_2CHCH_2CH_2OH$
 - 3. Molecular weight: 88
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 132 C (270 F)
 - 2. Specific gravity (water=1): 0.8
 - 3. Vapor density (air = 1 at boiling point of isoamyl alcohol): 3.0
 - 4. Melting point: -117 C (-179 F)
 - 5. Vapor pressure at 20 C (68 F): 2 mm Hg
 - 6. Solubility in water, % by weight at 20 C (68 F): 2.4
 - 7. Evaporation rate (butyl acetate = 1): 0.2
 - 8. Appearance and odor: Colorless liquid with an alcoholic odor that causes coughing
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Flash point: 42.8 C (109 F) (closed cup)
 - 2. Autoignition temperature: 350 C (662 F)
 - 3. Flammable limits in air, % by volume: (at 212 F)
Lower: 1.2; Upper: 9.0
 - 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: Isoamyl alcohol is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where isoamyl alcohol is used, handled or stored. Isoamyl alcohol vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which isoamyl alcohol is handled.
 - 7. For purposes of complying with the requirements of 29 CFR 1910.106, isoamyl alcohol is classified as a Class II combustible liquid. At 3000 ppm, one-fourth of the lower

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flammable limit, isoamyl alcohol 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 isoamyl alcohol shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: heat
2. Incompatibilities: Contact with strong oxidizers may cause fire and explosion
3. Hazardous decomposition products: toxic gases and vapors (such as carbon monoxide) may be released in a fire involving isoamyl alcohol.
4. Special precautions: Isoamyl alcohol will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isoamyl alcohol 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) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber. Isoamyl alcohol 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:

Isoamyl alcohol may be disposed of:

1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a sanitary landfill.
2. By atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

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

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

V. MISCELLANEOUS PRECAUTIONS

- A. Store isoamyl alcohol in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to isoamyl alcohol can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal isoamyl alcohol containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers must advise employees of all plant areas and operations where exposure to isoamyl alcohol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to isoamyl alcohol is likely to occur are: in the manufacture and use of paints, lacquers, varnishes, thinners, paint removers, printing inks, anti-foaming agents and carburing fluids containing isoamyl alcohol; its use in the synthesis and processing of pharmaceutical products; its use as a chemical intermediate in organic synthesis; its use as a solvent for resins, gums, waxes and oils; in its manufacture; in its use as a frothing agent for the flotation of nonferrous ores; and in its use in microscopic procedures.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Isoamyl alcohol vapor is a mild irritant. Among the few reports of experience with the amyl alcohols, exposure of rats to vapor at 8,000 ppm was not lethal. Chemically related alcohols are considered to have predominantly narcotic properties at high concentrations. Slight throat irritation has been observed in unacclimated subjects at 100 ppm, and objectionable irritation of the eyes, nose and throat at higher concentrations. No chronic systemic effects from isoamyl alcohol have been reported in humans.

III. SIGNS AND SYMPTOMS

Irritation of the eyes, nose and throat. May be narcotic at sustained high levels.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Give artificial resuscitation if indicated. Wash eyes and contaminated skin with water. If swallowed and the person is conscious, induce vomiting. Recovery is usually complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

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

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1. Skin disease -- Isoamyl alcohol 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.
2. Liver disease -- Although isoamyl alcohol is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.
3. Kidney disease -- Although isoamyl alcohol is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with possible impairment of renal function.
4. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway disease, the breathing of isoamyl alcohol might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

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

References

1. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishers, New York, 1963, pp. 1451-1459.
2. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 362-363.
3. Smyth, H. F., Jr.: "Improved Communication -- Hygienic Standards for Daily Inhalation," Industrial Hygiene Quarterly, 17:145-146, June 1956.
4. American Conference of Governmental Industrial Hygienists: "Isoamyl Alcohol," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 139.

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REFERENCES AND SOURCES

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1910.93

(f) Personal Protective Equipment, and, (h) Sanitation

Eye: Union Carbide Corp. MSDS

Skin: Patty, "Industrial Hygiene and Toxicology;" Browning, "Toxicity and Metabolism of Industrial Solvents"

Ingestion: Browning, "Toxicity and Metabolism of Industrial Solvents;"
Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

A Union Carbide MSDS states "contact of liquid with eye causes severe irritation." No other statements concerning the effects of this substance could be found in the literature . . . It is, therefore, assigned a classification of 2.

Skin - Classification: 2

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

Exceptions: None

Patty reports "no effects upon the nerves of the skin of men, and no local wheal formation, erythema, or hyperemia were observed by Oettel following the application of all isomers except 1-pentanol. Schwartz and Tulipan state that isoamyl . . . alcohols may be irritating to the skin." Also reported is that "mice were narcotized by immersion in dilute aqueous solutions of amyl alcohol under conditions that prevented ingestion and inhalation of the alcohol." Browning attributes this latter effect to isoamyl alcohol, not amyl alcohol.

It can also be safely stated that the substance, like other fat solvents, can cause defatting and cracking of the skin after repeated or prolonged contact.

Isoamyl alcohol has a vapor pressure of 2 mm Hg at 20 degrees C. It is 2.4% soluble in water and has a flash point of 109 degrees F.

More definitive data concerning the rate at which the substance is absorbed through the skin could not be found. The data do clearly indicate, however, that repeated or prolonged contact with significant amounts is to be avoided. The substance is, therefore, assigned a classification of 2.

Ingestion - Classification: 2

Output statement numbers: 2b

Exceptions: None

Browning reports "by oral administration its toxicity is less than that of the secondary and tertiary isomers. Its toxic effects are mainly those of narcosis, with symptoms relating to the central nervous system." Without specifying a particular isomer, Patty reports "the occurrence of liver injury in the rabbit following repeated oral administration of amyl alcohol." Browning states "the main site of primary oxidation (of isoamyl alcohol) appears to be the liver." Both sources give an oral lethal dose for rabbits of 4.25 ml/kg. Browning adds

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that the oral narcotic dose for guinea pigs is 0.69 g/kg.

Given its low vapor pressure and its potential to cause liver damage, the substance is assigned a classification of 2.

SUBSTANCE TECHNICAL GUIDELINES
ISOAMYL ALCOHOL

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: 3-methyl-1-butanol; isobutylcarbinol; isopentyl alcohol; fermentation amyl alcohol; fusel oil
 - 2. Formula: $(CH_3)_2CHCH_2CH_2OH$
 - 3. Molecular weight: .88
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 132 C (270 F)
 - 2. Specific gravity (water=1): 0.8
 - 3. Vapor density (air = 1 at boiling point of isoamyl alcohol): 3.0
 - 4. Melting point: -117 C (-179 F)
 - 5. Vapor pressure at 20 C (68 F): 2 mm Hg
 - 6. Solubility in water, % by weight at 20 C (68 F): 2.4
 - 7. Evaporation rate (butyl acetate = 1): 0.2
 - 8. Appearance and odor: Colorless liquid with an alcoholic odor that causes coughing
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Flash point: 42.8 C (109 F) (closed cup)
 - 2. Autoignition temperature: 350 C (662 F)
 - 3. Flammable limits in air, % by volume: (at 212 F)
Lower: 1.2; Upper: 9.0
 - 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: Isoamyl alcohol is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where isoamyl alcohol is used, handled or stored in a manner that could create a potential fire or explosion hazard. Isoamyl alcohol vapors are heavier than air and may travel along the ground and be ignited by sparks or open flames at locations remote from the site at which isoamyl alcohol is handled.
 - 7. For purposes of complying with the requirements of 29 CFR 1910.106, isoamyl alcohol is classified as a Class II combustible liquid. For example, 3000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which isoamyl alcohol 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

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500 of the National Electrical Code for isoamyl alcohol shall be Class I Group D.

B. Reactivity

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

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isoamyl alcohol is spilled or leaked, the following steps should be taken:
1. Remove all ignition sources.
 2. Ventilate area of spill or leak.
 3. For small quantities, absorb on paper towels. Remove to a safe place (such as a fume hood) and burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- C. Waste disposal methods: Isoamyl alcohol may be disposed of:
1. By absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
 2. By atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

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

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25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

- A. Store isoamyl alcohol in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to isoamyl alcohol can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal isoamyl alcohol containers. These containers must be effectively grounded and bonded prior to pouring.
- D. Employers should advise employees of all plant areas and operations where exposure to isoamyl alcohol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to isoamyl alcohol is likely to occur are: in the manufacture and use of paints, lacquers, varnishes, thinners, paint removers, printing inks, anti-foaming agents and carburing fluids containing isoamyl alcohol; its use in the synthesis and processing of pharmaceutical products; its use as a chemical intermediate in organic synthesis; its use as a solvent for resins, gums, waxes and oils; in its manufacture; in its use as a frothing agent for the flotation of nonferrous ores; and in its use in microscopic procedures.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Isoamyl alcohol

D.O.L. STANDARD: 100 ppm

WARNING PROPERTIES:

Odor Threshold: Quantitative information concerning the odor threshold of isoamyl alcohol is not available. The Handbook of Industrial Solvents, however, states that the odor of n-amyl alcohol is "apparent at approximately 60 ppm." Staub reports an odor threshold for amyl alcohol of 35 ppm and Summer reports an odor threshold of 10 ppm. By analogy, it is assumed that the odor of isoamyl alcohol is also below the TLV.

Irritation Levels: Patty states that "according to Nelson et al., the following concentrations of 3-methyl-1-butanol (isoamyl alcohol) caused irritation of the respective mucous membranes of the majority of persons subjected to exposure for a few minutes: eyes, 150 ppm (0.54 mg/liter; nose, 150 ppm; and throat, 100 ppm (0.36 mg/liter)."

Evaluation of Warning Properties: Because of its irritant effects (and also probably its odor), isoamyl alcohol is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted. IDLH: 8000 ppm

Basis for IDLH Value: There are no acute inhalation toxicity data available specifically for isoamyl alcohol. This chosen IDLH (8000 ppm), therefore, is based upon the report in Patty that "rats survived when exposed to amyl alcohol in the concentration of 8000 ppm (close to saturation) . . ."

Other Toxicological Information: Patty states that: "Except for one report by Smyth, in which rats survived when exposed to amyl alcohol in the concentration of 8000 ppm (close to saturation), animals have not been exposed experimentally to the vapors of any of the amyl alcohols, but most investigators have found that amyl alcohol administered otherwise is more narcotic and

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lethal than the lower homologs. Baer and Munch and Schwartz compared amyl alcohol with the lower homologs by their oral administration to rabbits and found the latter less toxic. Jeffroy and Serveaux and Lehman and Newman obtained similar results following intravenous administration of alcohols to rabbits; Macht arrived at the same conclusion from corresponding experiments upon cats. Intraperitoneal injections of the alcohols into rats, by Lendle, likewise showed that amyl alcohol was more toxic than the lower homologs."

The Documentation of TLV's states that: "Smyth (3) stated that: 'The most important effect of amyl alcohol inhalation is narcosis. The 100 ppm threshold limit can be interpreted from human sensory data and analogy with butyl alcohol. It is low enough to prevent significant narcosis, but not to prevent slight irritation.'"

LFL: 12,000 ppm

VAPOR PRESSURE AT 20 C: 2 mm Hg

SATURATED CONCENTRATION AT 20 C: 2630 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
ISOAMYL ALCOHOL

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid during the application of paints, lacquers, varnishes, thinners and paint removers. (Isoamyl alcohol is vehicle, latent or diluent solvent)	A,B	Local exhaust ventilation; general dilution ventilation
2. Inhalation of vapor and skin contact with liquid during use in the pharmaceutical industry (synthesis of drugs and medicinals, solvent for alkaloids, extractant of antibiotics)	A,B	Local exhaust ventilation; general dilution ventilation
3. Inhalation of vapor and skin contact with liquid during manufacture of lacquers, paints, varnishes, thinners and paint removers	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (goggles, protective clothing)
4. Inhalation of vapor and skin contact with liquid during use as a chemical intermediate in organic synthesis (photographic chemicals, isoamyl compounds especially isoamyl acetate and other esters)	A,B	Local exhaust ventilation; general dilution ventilation; as needed-enclosure process; personal protective equipment (goggles, protective clothing)
5. Inhalation of vapor and skin contact with liquid during the manufacture and use of printing inks (quick drying inks, planographic inks, intaglio emulsoid inks)	A,B	Local exhaust ventilation; general dilution ventilation
6. Inhalation of vapor and skin contact with liquid during use as a solvent for resins, gums, waxes and oils (perfumes, explosives, shoe cement, analytical determination for fat in milk, artificial rubber)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (goggles)
7. Inhalation of vapor during	A	Local exhaust ventilation;

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manufacture of
isoamyl alcohol

general dilution ventila-
tion; enclosed process

- | | | | |
|-----|---|-----|---|
| 8. | Inhalation of vapor and skin contact during cleaning and maintenance of storage tanks | A,B | Local exhaust ventilation; general dilution ventila-
tion; personal protective
equipment (goggles, respira-
tory protective devices,
protective clothing) |
| 9. | Inhalation of vapor and skin contact with liquid during manufacture and use in anti-foaming agents and carburing fluids | A,B | Local exhaust ventilation;
general dilution ventila-
tion |
| 10. | Inhalation of vapor and skin contact with liquid during use in the mining industry as a frothing agent for the flotation of nonferrous ores | A,B | Local exhaust ventilation;
general dilution ventila-
tion |
| 11. | Inhalation of vapor and skin contact with liquid during use in microscopy (vehicle solvent for celloidin solutions) | A,B | Local exhaust ventilation;
general dilution ventila-
tion |

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