

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND  
SUPPORTING DOCUMENTATION FOR

\*\*\* PROPYL ALCOHOL \*\*\*

NIOSH/OSHA Draft Technical Standard  
and Supporting Documentation for PROPYL 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 PROPYL 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 propyl alcohol in concentrations not in excess of 200 parts per million (ppm) (500 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 propyl alcohol.
- (b) EMPLOYEE INFORMATION - Each employer who has a workplace in which propyl 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 PROPYL ALCOHOL - Inform affected employees of the quantity, location, and manner of use or storage of propyl alcohol.
- (c) EXPOSURE MEASUREMENT
- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which propyl alcohol is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of propyl 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 propyl 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 propyl alcohol;
- (ii) Any measurements of airborne concentrations of propyl alcohol taken;
- (iii) Any employee complaints of symptoms which may be attributable to exposure to propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl alcohol shall be classified as B-2 at 70 F.
  - (iii) Where a fan is located in duct work and where propyl alcohol is present in concentrations greater than 5250 ppm, one fourth of the lower flammable limit, the fan rotating element shall be of non-sparking 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 PROPYL ALCOHOL

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 1000 ppm	cartridge(s). Any supplied-air respirator.
-----	
Equal to or less than 5000 ppm	
-----	
Equal to or less than 10 000 ppm	Any supplied-air respirator with a full facepiece. Any self-contained breathing apparatus with a full facepiece.
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Equal to or less than 16 000 ppm	

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or with a full facepiece, helmet or hood operated in continuous-flow mode.

Greater than 16 000 ppm, or Entry and Escape from Unknown Concentrations	Self-contained breathing apparatus with a full facepiece air respirator with a full facepiece 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 propyl alcohol which is contained in Appendix B in order to ensure the safe handling and use of propyl alcohol.

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of propyl alcohol shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, propyl 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 propyl alcohol shall be Class I Group D.
- (4) Flammable liquids - For the purposes of compliance with section 1910.106, liquid propyl alcohol is classified as a Class IB flammable 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 propyl alcohol is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - Propyl 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

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prevent repeated or prolonged skin contact to liquid propyl alcohol. Face shields shall comply with section 1910.133(a)(6).

- (ii) Employers shall ensure that clothing which becomes wet with liquid propyl alcohol be removed immediately and not reworn until the propyl alcohol is removed from the clothing.
  - (iii) Employers shall ensure that clothing wet with liquid propyl alcohol is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of propyl alcohol from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the propyl alcohol, the employer shall inform the person performing the operation of the hazardous properties of propyl 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 propyl alcohol may occur.
- (h) Spills
- (1) Spills of propyl alcohol shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
  - (2) Liquid propyl 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 propyl alcohol promptly wash or shower as necessary to remove any propyl alcohol from the skin.
- (j) Training and Information - Each employer who has employees exposed to propyl alcohol in excess of the action level, or employees who may have skin or eye contact with liquid propyl alcohol, or employees who work where accidental release, spill, fire, or explosion of propyl alcohol may occur, shall annually:
- (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for propyl alcohol, which is contained in Appendix A; and
  - (2) Medical -
    - (I) Advise employees as to the signs and symptoms of exposure to propyl alcohol.
    - (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to propyl 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 propyl 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 propyl alcohol, or airborne concentrations of propyl 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 propyl 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 propyl 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 propyl 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 propyl alcohol;
- (II) A description of the employee's duties as they relate to his exposure to propyl 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 propyl 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 propyl 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 propyl 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.

- (i) The employer shall keep an accurate record of all initial determinations required to be made pursuant to paragraph (c)(1) of this section.
- (ii) The record shall include the written determination and any supporting documentation as required in paragraph (c)(1) of this section.

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- (iii) This record shall be maintained until replaced by a more recent record.
- (2) Exposure measurements.
  - (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to propyl 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 propyl 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 propyl 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.

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- (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary and the Director.
  - (ii) Employee exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
  - (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (m) Observation of monitoring.
- (1) Duty.  
The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to propyl 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 propyl 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 propyl 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 propyl 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: Propyl alcohol

PERMISSIBLE EXPOSURE: 200 parts of propyl alcohol vapor per million parts of air (ppm) or 500 milligrams of propyl alcohol vapor per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with a mild, non-residual alcoholic odor

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Propyl 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: Exposure to high air concentrations of propyl alcohol may cause mild irritation of the eyes, nose and throat. Drowsiness, headaches, and incoordination may also occur. Swallowing propyl alcohol may cause drowsiness, unconsciousness and death. Gastrointestinal pain, cramps, nausea, vomiting and diarrhea may also result from swallowing this alcohol.
2. Long-Term Overexposure: Prolonged skin exposure may cause drying and cracking of the skin.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with propyl alcohol, exposure.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If propyl 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 propyl alcohol gets on your skin flush the contaminated skin with water. If propyl alcohol soaks through your clothing remove the clothing immediately and flush the skin with water. Do not rewear the clothing until the propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl 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 propyl alcohol contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Propyl alcohol is a flammable liquid and its vapors easily form explosive mixtures with air. It must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames and strong oxidizers. Sources of ignition such as smoking and open flames are prohibited wherever propyl 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 propyl alcohol, and containers must be bonded and grounded when pouring or transferring liquid propyl alcohol. If your skin becomes wet with liquid propyl alcohol, you must promptly wash or shower as necessary to remove the propyl alcohol from your skin. You must immediately remove any clothing that becomes wet with liquid propyl alcohol and this clothing must not be reworn until the propyl alcohol is removed from the clothing. Fire extinguishers and eye flushing facilities, where provided, must be

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readily available and you should know where they are and how to operate them. Ask your supervisor where propyl 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  
PROPYL ALCOHOL

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: N-propyl alcohol; 1-propanol; ethyl carbinol
  2. Formula:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
  3. Molecular weight: 60
- B. Physical Data
1. Boiling point (760 mm Hg): 97 C (207 F)
  2. Specific gravity (water = 1): 0.8
  3. Vapor density (air = 1 at boiling point of propyl alcohol): 2.1
  4. Melting point: -126 C (-195 F)
  5. Vapor pressure at 20 C (68 F): 15 mm Hg
  6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
  7. Evaporation rate (butyl acetate = 1): 1.3
  8. Appearance and odor: Colorless liquid with a mild, non-residual alcoholic odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Flash point: 15 C (59 F) (closed cup)
  2. Autoignition temperature: 440 C (824 F)
  3. Flammable limits in air, % by volume: Lower: 2.1; Upper: 13.5
  4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
  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: Propyl alcohol is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where propyl alcohol is handled, used or stored. Propyl alcohol 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 propyl alcohol is handled.
  7. For purposes of conforming with the requirements of 29 CFR 1910.106, propyl alcohol is classified as a Class IB flammable liquid. At 5250 ppm, one-fourth of the lower flammable limit, propyl alcohol is considered to be a potential fire and explosion hazard.

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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 propyl 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 propyl alcohol.
4. Special precautions: Propyl alcohol will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If propyl 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. Propyl 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:

Propyl 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 propyl 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

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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 propyl alcohol to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

- A. Store propyl alcohol in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to propyl alcohol can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal propyl 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 propyl alcohol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to propyl alcohol is likely to occur are: its use in surface coatings; as an intermediate in organic synthesis; in the processing of textiles, leather, acrylonitrile and cellulose; its use as an ingredient in polishing and cleaning preparations; its use as a degreasing agent and extractant.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; minor skin absorption.

II. TOXICOLOGY

The principal action of propyl alcohol is that of a mild narcotic, but it may also act as an upper respiratory tract irritant. Mice exposed to vapor developed ataxia in 90 to 120 minutes at 3,250 ppm; deep narcosis occurred after 240 minutes exposure at 4,100 ppm. Propyl alcohol is absorbed, oxidized and eliminated more rapidly than is ethyl alcohol. Skin absorption has been demonstrated in animals, as well as mild irritation of the skin on repeated exposure due to defatting action. No chronic systemic effects have been reported in humans.

III. SIGNS AND SYMPTOMS

Mild irritation of the eyes, nose and throat. Drying and cracking of the skin may result from repeated skin exposure. Exposure to high vapor concentrations may be expected to cause drowsiness, headache, and ataxia.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposures. 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 propyl alcohol are caused by its irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to propyl 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

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

1. Skin disease -- Propyl 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 propyl 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 propyl 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 impaired renal function.
4. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway disease, the breathing of propyl alcohol might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

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

References

1. American Conference of Governmental Industrial Hygienists: "Propyl Alcohol," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 217.
2. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 332-334.
3. Hygienic Guide Series: "Propyl Alcohol," Industrial Hygiene Journal, 22:520-522, 1961.

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REFERENCES AND SOURCES

PROPYL ALCOHOL

1910.93

- (f) Personal Protective Equipment, and, (h) Sanitation  
Eye: Grant, "Toxicology of the Eye;" "Propyl Alcohol," Union Carbide Corp. Toxicology Study  
Skin: Sax, "Dangerous Properties of Industrial Materials;" "Encyclopedia of Occupational Safety and Health," International Labour Office; "Propyl Alcohol," Union Carbide Corp. Toxicology Study; Patty, "Industrial Hygiene and Toxicology"  
Ingestion: "Encyclopedia of Occupational Safety and Health," International Labour Office; Browning, "Toxicity and Metabolism of Industrial Solvents;" "Propyl Alcohol," Union Carbide Corp. Toxicology Study

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Grant reports that "in aqueous solutions at 1.2 to 5 M concentration it has been found to have a moderate loosening effect on the epithelium of beef corneas, resembling n-butyl alcohol, but less effective. Tested on rabbit eyes, it has had moderately injurious effect on the cornea, graded 5 on a scale of 1 to 10 after 24 hours, but the ultimate result was not reported." Discussing solvent splash injuries on page 7, he notes "even if all the epithelium is lost from the cornea . . . it generally regenerates in a few days without residual permanent damage." Union Carbide reports "a small droplet caused severe irritation in the eye . . . comparable to that caused by tincture of green soap."

There is no indication in the literature that the substance causes irreversible injury while there is indication that any injury caused is temporary. The substance is, therefore, assigned a classification of 2.

Skin - Classification: 2

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

Exceptions: None

Sax lists the substance as being an acute local irritant of slight toxic hazard. ILO reports "skin contact will give rise to no more than slight erythema and dryness." Union Carbide lists a single skin penetration LD50 for rabbits of 5.04 ml/kg and reports "the undiluted chemical caused no reaction on the tender skin of the rabbit belly greater than a faint redness of short duration." Patty reports that one source observed no skin irritation from a single application to rabbit skin while another observed "slight erythema and dryness." Multiple applications were noted as causing dryness and superficial desquamation. He gives the same skin penetration LD50 as Union Carbide's but also notes that another researcher found the MLD to be greater than 9. ml/kg by this route.

Propyl alcohol has a vapor pressure of 15 mm Hg at 20 degrees C. It is miscible in all proportions with water and has a flash

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point of 77 degrees F.

A classification of 2 is concluded to be appropriate.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

ILO reports that "animals oxidise (sic) n-propyl alcohol more rapidly than isopropyl or ethyl alcohol. It is slightly toxic when ingested . . ." Browning adds that it is first oxidized to propionic acid and then to carbon dioxide and water. She continues "in man, ingestion of 20 ml diluted with water causes only a feeling of warmth and slight lowering of the blood pressure." Union Carbide gives a single oral dose LD50 in rats of 3.73 ml/kg.

It is clear that, in the context of this standard, ingestion would not present a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES  
PROPYL ALCOHOL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: N-propyl alcohol; 1-propanol; ethyl carbinol
2. Formula:  $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
3. Molecular weight: 60

B. Physical Data

1. Boiling point (760 mm Hg): 97 C (207 F)
2. Specific gravity (water = 1): 0.8
3. Vapor density (air = 1 at boiling point of propyl alcohol): 2.1
4. Melting point: -126 C (-195 F)
5. Vapor pressure at 20 C (68 F): 15 mm Hg
6. Solubility in water, % by weight at 20 C (68 F):  
Miscible in all proportions
7. Evaporation rate (butyl acetate = 1): 1.3
8. Appearance and odor: Colorless liquid with a mild, non-residual alcoholic odor

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 15 C (59 F) (closed cup)
2. Autoignition temperature: 440 C (824 F)
3. Flammable limits in air, % by volume: Lower: 2.1;  
Upper: 13.5
4. Extinguishing media: Alcohol foam, dry chemical, carbon dioxide
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: Propyl alcohol is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where propyl alcohol is handled, used or stored in a manner that could create a potential fire or explosion hazard. Propyl alcohol vapors are heavier than air and may travel

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along the ground and be ignited by open flames or sparks at locations remote from the site at which propyl alcohol is handled.

7. For purposes of conforming with the requirements of 29 CFR 1910.106, propyl alcohol is classified as a Class IB flammable liquid. For example, 5300 ppm, approximately one-fourth of the lower flammable limit, is one situation in which propyl 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 propyl 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 propyl alcohol.
4. Special precautions: Propyl alcohol will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If propyl 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). 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. Propyl 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: Propyl alcohol may be disposed of by atomizing in a suitable combustion chamber.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the 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

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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 propyl 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 propyl alcohol to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

- A. Store propyl alcohol in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to propyl alcohol can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal propyl 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 propyl alcohol could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to propyl alcohol is likely to occur are: its use in surface coatings; as an intermediate in organic synthesis; in the processing of textiles, leather, acrylonitrile and cellulose; its use as an ingredient in polishing and cleaning preparations; and its use as a degreasing agent and extractant.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Propyl alcohol

D.O.L. STANDARD: 200 ppm

WARNING PROPERTIES:

Odor Threshold: Both Summer and Staub report odor thresholds for n-propanol 30 ppm.

Eye Irritation Level: n-Propyl alcohol, according to Grant, resembles "ethyl alcohol in physical and toxic properties." Grant states that a vapor concentration of 2500 ppm has "no notable effect on the eyes." The AIHA Hygiene Guides note that above 5500 ppm ethyl alcohol, some eye and nasal irritation occur.

Evaluation of Warning Properties: Since the odor threshold of n-propyl alcohol is below the permissible exposure limit (200 ppm), propyl alcohol is treated as a material with adequate warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 4000 ppm

Basis for IDLH Value: This IDLH is based upon the report in Patty that 2 out of 6 rats died following a 4-hour exposure to 4000 ppm n-propyl alcohol. In addition, Patty reports that deep narcosis was produced in mice exposed to 4100 ppm for 4 hours.

Other Toxicological Information: Patty reports that: "Animals exposed to sublethal concentrations of the vapors of n-propyl alcohol may manifest the following signs of intoxication: irritation of the mucous membranes, ataxia, lethargy."

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prostration, narcosis, and death. Rats survived when exposed for 2 hours to the saturated vapor by Smyth et al. However, these investigators obtained death in 2 of 6 rats exposed for 4 hours to the concentrations of 4000 ppm.

"Weese found that mice survived when they were exposed intermittently to the narcotic vapor of 7874 ppm in air (19.3 mg/liter) for a total period of 120 minutes, but died if exposed for 160 minutes to 13,120 ppm (32.2 mg/liter) or 120 minutes to 19,680 ppm (48.2 mg/liter).

"Groups of mice (2 in each) were exposed by Starrek for decreasing lengths of time (480, 240, 135, 120, 90, and 60 minutes) to increasing concentrations of n-propyl alcohol in the atmosphere (( 3250 ppm (8 mg/liter), 4100 ppm (10 mg/liter), 8150 ppm (20 mg/liter), 12,250 ppm (30 mg/liter), 16,300 ppm (40 mg/liter), and 24,500 ppm (60 mg/liter) ). The length of time required for the appearance of ataxia, prostration, and deep narcosis was inversely proportional to the concentration to which the mice were exposed. Ataxia appeared in 10 to 14 minutes at 24,500 ppm and in 90 to 120 minutes at 3250 ppm. Prostration was evident in 19 to 23 minutes at the former concentrations and 165 to 180 minutes at the latter. Deep narcosis was manifest in 60 minutes at 24,500 ppm and in 240 minutes at 4100 ppm. Only 1 of 12 mice that showed signs of intoxication died. Mice exposed for 480 minutes to 2050 ppm (5 mg/liter) showed no reaction."

The Documentation of TLV's states that: "By analogy with isopropyl alcohol (for which the TLV was set to prevent narcosis and significant irritation), a TLV of 200 ppm is recommended."

LFL: 21,000 ppm

VAPOR PRESSURE AT 20 C: 15 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 19,700 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT  
PROPYL ALCOHOL

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during spray (or any other method involving heat) application of surface coatings containing solvent (nitrocellulose lacquers, polystyrene coatings, dopes, or artist's fixative)	A,B,D	Local exhaust ventilation; personal protective equipment (gloves, goggles, respiratory protective devices)
2.	Inhalation of vapor during use as a chemical intermediate in organic synthesis (n-propyl acetate, propionic acid, n-propylated ureas, propion aldehyde, propylamine)	A	Local exhaust ventilation; general dilution ventilation
3.	Inhalation of vapor and skin contact with liquid during printing on plastic film and sheeting with polyamide-based inks containing solvent	A,B,D	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
4.	Inhalation of vapor and skin contact with liquid during textile and leather processing (finishing, wool dyeing, swelling agent for wool)	A,B,D	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
5.	Inhalation of vapor and skin contact with liquid during other than spray or heat-involved application of surface coatings containing solvent (nitrocellulose lacquers, dopes, polystyrene coatings)	A,B,D	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
6.	Inhalation of vapor and skin contact with liquid during manufacture and packaging of surface coatings containing solvent (nitrocellulose lacquers, dopes, polystyrene coatings, inks, dyes, textile and	A,B,D	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)

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leather finishes, artist's  
fixative)

- |     |   |       |  |
|-----|---|-------|--|
| 7.  | Inhalation of vapor and skin contact with liquid during synthesis and packaging of substance  | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |
| 8.  | Inhalation of vapor and skin contact with liquid during manufacture and packaging of cleaning preparations and polishing agents (soaps, window cleaners, floor wax, polishes, disinfectants, nail polish, dental lotions) | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |
| 9.  | Inhalation of vapor and skin contact with liquid during extraction processing (vegetable oils including castor oil and pharmaceuticals)   | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |
| 10. | Inhalation of vapor and skin contact with liquid during cleaning and degreasing operations (including metal degreasing)   | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |
| 11. | Inhalation of vapor and skin contact with liquid during cellulose processing (carboxylation)  | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (goggles, gloves) |
| 12. | Inhalation of vapor and skin contact with liquid during spinning of acrylonitrile   | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |
| 13. | Inhalation of vapor and skin contact with liquid during manufacture and packaging of brake fluids   | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles) |

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

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

1,310 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

