

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** ISOPROPYL ALCOHOL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ISOPROPYL 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 ISOPROPYL 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 isopropyl alcohol in concentrations not in excess of 400 parts per million (ppm) (980 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 isopropyl alcohol.

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

(c) EXPOSURE MEASUREMENT

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

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but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

- (5) EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE - If an employee exposure measurement reveals that an employee is exposed to airborne concentrations of isopropyl 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 isopropyl 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 isopropyl 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 isopropyl 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 isopropyl alcohol shall be classified as B-1 at 70 F.
 - (iii) Where a fan is located in duct work and where isopropyl alcohol is present in concentrations greater than 5000 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.

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(2) Respirators

- (i) Compliance with the permissible exposure may not be achieved by the use of respirators except:
 - (a) During the time period necessary to install engineering controls; or
 - (b) In work situations in which engineering controls are technically not feasible; or
 - (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 ISOPROPYL ALCOHOL

Condition	Permissible Respiratory Protection
Vapor Concentration	
Equal to or less than 1000 ppm	organic vapor cartridge(s).
Equal to or less than 5000 ppm	
Equal to or less than 12 000 ppm	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than	Self-contained breathing apparatus with a full facepiece

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12 000 ppm, or Entry and Escape from Unknown Concentrations	air respirator with a full facepiece operated in pressure- auxiliary self-contained air supply operated in pressure- demand mode.
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Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand (positive pressure) mode.
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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 isopropyl alcohol which is contained in Appendix B in order to ensure the safe handling and use of isopropyl alcohol.

- (1) Electrical - For the purposes of compliance with section 1910.309, locations classified as hazardous locations due to the presence of isopropyl alcohol shall be Class I Group D.
- (2) Portable fire extinguishers - For the purposes of compliance with section 1910.157, isopropyl 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 isopropyl alcohol shall be Class I Group D.
- (4) Flammable liquids - For the purposes of compliance with section 1910.106, liquid isopropyl 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 isopropyl alcohol is handled, used or stored in a manner so as to create a potential fire or explosion hazard.
- (6) Storage - Isopropyl alcohol shall be stored so as not to come in contact with strong oxidizers or hot metallic aluminum.

(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 isopropyl alcohol. Face shields shall comply with section 1910.133(a)(6).
- (ii) Employers shall ensure that clothing which becomes wet with liquid isopropyl alcohol be removed immediately and not

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reworn until the isopropyl alcohol is removed from the clothing.

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

(h) Spills

- (1) Spills of isopropyl alcohol shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
- (2) Liquid isopropyl 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 isopropyl alcohol promptly wash or shower as necessary to remove any isopropyl alcohol from the skin.

- (j) Training and Information - Each employer who has employees exposed to isopropyl alcohol in excess of the action level, or employees who may have skin or eye contact with liquid isopropyl alcohol, or employees who work where accidental release, spill, fire, or explosion of isopropyl alcohol may occur, shall annually:

- (1) Substance Safety Data Sheet - Inform each employee of the information contained in the Substance Safety Data Sheet for isopropyl alcohol, which is contained in Appendix A; and

(2) Medical -

- (I) Advise employees as to the signs and symptoms of exposure to isopropyl alcohol.
- (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to isopropyl 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 isopropyl alcohol.
- (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

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- (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 isopropyl alcohol, or airborne concentrations of isopropyl 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 isopropyl 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 isopropyl 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 isopropyl alcohol.
- (9) Informing the Physician - The employer shall provide to the examining physician the following information:
 - (I) A copy of this section with its Appendices A, B and C for isopropyl alcohol;
 - (II) A description of the employee's duties as they relate to his exposure to isopropyl alcohol;
 - (III) A description of any personal protective equipment,

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

(2) Exposure measurements.

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- (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to isopropyl 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 isopropyl 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 isopropyl 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.

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- (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 isopropyl 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 isopropyl 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 isopropyl 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 isopropyl 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: Isopropyl alcohol

PERMISSIBLE EXPOSURE: 400 parts of isopropyl alcohol vapor per million parts of air (ppm) or 980 milligrams of isopropyl alcohol vapor per cubic meter of air (mg/cu m).

APPEARANCE AND ODOR: Colorless liquid with an odor of rubbing alcohol

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Isopropyl 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 isopropyl alcohol may cause mild irritation of the eyes, nose and throat. Drowsiness, headache and incoordination may also occur. Swallowing isopropyl 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: Drying and cracking of the skin may result from prolonged skin exposure.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with isopropyl alcohol exposure.

III. EMERGENCY FIRST AID PROCEDURES

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

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

Isopropyl 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, strong oxidizers and hot metallic aluminum. Sources of ignition such as smoking and open flames are prohibited wherever isopropyl 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 isopropyl alcohol, and containers must be bonded and grounded when pouring or transferring liquid isopropyl alcohol. If your skin becomes wet with liquid isopropyl alcohol, you must promptly wash or shower as necessary to remove the isopropyl alcohol from your skin. You must immediately remove any clothing that becomes wet with liquid isopropyl alcohol and this clothing must not be re-worn

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until the isopropyl alcohol is removed from the clothing. 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 isopropyl 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
ISOPROPYL ALCOHOL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Isopropanol; IPA; 2-propanol; sec-propyl alcohol
2. Formula: $\text{CH}_3\text{CHOHCH}_3$
3. Molecular weight: 60

B. Physical Data

1. Boiling point (760 mm Hg): 82 C (180 F)
2. Specific gravity (water = 1): 0.78
3. Vapor density (air = 1 at boiling point of isopropyl alcohol): 2.1
4. Melting point: -89 C (-128 F)
5. Vapor pressure at 20 C (68 F): 33 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate = 1): 2.83
8. Appearance and odor: Colorless liquid with an odor of rubbing alcohol

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 12 C (53 F) (closed cup)
2. Autoignition temperature: 399 C (750 F)
3. Flammable limits in air, % by volume: Lower: 2.0; Upper: 12.0
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: Isopropyl alcohol is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where isopropyl alcohol is handled, used or stored. Isopropyl 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 isopropyl alcohol is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, isopropyl alcohol is classified as a Class IB flammable liquid. At 5000 ppm, one-fourth of the lower

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flammable limit, isopropyl 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 isopropyl 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 isopropyl alcohol.
4. Special precautions: Isopropyl alcohol will attack some forms of plastics, rubber and coatings. It also may react with metallic aluminum at high temperatures.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isopropyl 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. Isopropyl 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:

Isopropyl 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

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analyses or dosimeters. The method of measurement must determine the concentration of isopropyl 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 isopropyl alcohol to plus or minus 25%. Methods meeting these accuracy requirements are available in the "NIOSH Monitoring Methods Manual".

V. MISCELLANEOUS PRECAUTIONS

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

VI. COMMON OPERATIONS

Common operations in which exposure to isopropyl alcohol is likely to occur are: its use as a solvent for resins, surface coatings, adhesives, perfumes, medicinals and cosmetics; as rubbing alcohol; as de-icer for automobile windshields; as an ingredient in a variety of products; and as a chemical intermediate.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation

II. TOXICOLOGY

The most important toxic effect of isopropyl alcohol is narcosis, which occurs in mice at vapor concentrations of 3,000 ppm, the effects increasing with the duration of exposure. Exposure to higher concentrations results in ataxia, followed by deep narcosis and death. Reversible fatty changes occurred in the liver of mice repeatedly exposed to high concentrations of vapor. Isopropyl alcohol is metabolized fairly rapidly, and acetone may be detected in the urine following heavy exposures. Human volunteers reported mild irritation of the eyes, nose and throat after 3 to 5 minutes exposure to vapor at 400 ppm; at 800 ppm the results were not severe, but most subjects found the atmosphere to be objectionable. Mild skin irritation occurs 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. High vapor concentrations may cause drowsiness, dizziness and headache. Drying and cracking of the skin may result from repeated skin exposure.

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 isopropyl alcohol are caused by its narcotic and irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to isopropyl 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. REPLACEMENT

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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.

1. Skin disease -- Isopropyl 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 isopropyl 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 isopropyl 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 isopropyl 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. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 335-341.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishers, New York, 1963, pp. 1436-1440.
3. Henson, E. V.: "Toxicology of Some Aliphatic Alcohols Part II," Journal of Occupational Medicine, 2:497-502, 1960.
4. American Conference of Governmental Industrial Hygienists: "Isopropyl Alcohol," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 141.

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REFERENCES AND SOURCES
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1910.93

- (f) Personal Protective Equipment, and (h) Sanitation
- Eye: Grant, "Toxicology of the Eye"
"Isopropyl Alcohol," Manufacturing Chemists' Association
Browning, "Toxicity and Metabolism of Industrial Solvents"
- Skin: "Encyclopedia of Occupational Safety and Health," International
Labour Office
"Isopropanol," Union Carbide Corp. Toxicology Study
"Isopropyl Alcohol," Manufacturing Chemists' Association
Patty, "Industrial Hygiene and Toxicology"
Browning, "Toxicity and Metabolism of Industrial Solvents"
- Ingestion: "Encyclopedia of Occupational Safety and Health, International
Labour Office
NIOSH Toxic Substances List, 1973
Patty, "Industrial Hygiene and Toxicology"

COMMENTS

- Eye - Classification: 2
Output statement numbers: 10
Exceptions: None

Grant reports that "tested by application of a drop to rabbit eyes, isopropyl alcohol caused mild transitory injury similar to that caused by ethylacetate, graded 4 on a scale of 1 to 10 after 24 hours. Irrigation of rabbit eyes for 3 minutes after 50% isopropyl alcohol in water caused reaction graded 50 on a scale of 0 to 100." The MCA reports "isopropyl alcohol is severely irritating to the eyes and may cause eye injury if not removed promptly." Browning reports hyperaemia, swelling and moderate turbidity of the cornea followed the application of 40% solutions, these features becoming more pronounced with stronger solutions."

Based on Grant's conclusion that the effects caused are mild and transitory, the substance is assigned a classification of 2.

- Skin - Classification: 2
Output statement numbers: 2, 7b, 21, 16i
Exceptions: None

ILO reports "only slight erythema may result from contact with the skin." Union Carbide reports that no skin irritation was produced when it was applied to the rabbit belly. It gives a single skin penetration LD50 for rabbits of 16.37 ml/kg. The MCA reports "isopropyl alcohol is not a skin irritant, nor is it readily absorbed through the skin, but prolonged or repeated skin contact may cause defatting of the skin." Patty reports that a single application to the skin of a rat causes "slight erythema" while multiple applications cause "slight erythema, dryness, (and) superficial desquamation." Browning states "isopropanol has no harmful effect when applied to the skin."

Isopropyl alcohol has a vapor pressure of 33 mm Hg at 20 degrees C. It is miscible in all proportions with water

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and has a flash point of 53 degrees F.

A classification of 2 is concluded to be appropriate.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

ILO reports "there is little or no accumulation of isopropyl alcohol in the body. It is practically non-toxic when ingested . . ." The Toxic Substances List gives an oral rat LD50 of 5.84 gm/kg. Patty reports that "no gross or microscopic abnormalities of the brain, pituitary, lung, heart, liver, spleen, kidneys, or adrenals of rats given 0.5 to 10.0 percent of isopropyl alcohol in their drinking water were observed . . ."

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

SUBSTANCE TECHNICAL GUIDELINES
ISOPROPYL ALCOHOL

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Isopropanol; IPA; 2-propanol; sec-propyl alcohol
2. Formula: $\text{CH}_3\text{CHOHCH}_3$
3. Molecular weight: 60

B. Physical Data

1. Boiling point (760 mm Hg): 82 C (180 F)
2. Specific gravity (water = 1): 0.78
3. Vapor density (air = 1 at boiling point of isopropyl alcohol): 2.1
4. Melting point: -89 C (-128 F)
5. Vapor pressure at 20 C (68 F): 33 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): Miscible in all proportions
7. Evaporation rate (butyl acetate = 1): 2.83
8. Appearance and odor: Colorless liquid with an odor of rubbing alcohol

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 12 C (53 F) (closed cup)
2. Autoignition temperature: 399 C (750 F)
3. Flammable limits in air, % by volume: Lower: 2.0; Upper: 12.0
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: Isopropyl alcohol is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where isopropyl alcohol is handled, used or stored in a

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manner that could create a potential fire or explosion hazard. Isopropyl 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 isopropyl alcohol is handled.

7. For purposes of conforming with the requirements of 29 CFR 1910.106, isopropyl alcohol is classified as a Class IB flammable liquid. For example, 5000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which isopropyl 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 isopropyl 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 isopropyl alcohol.
4. Special precautions: Isopropyl alcohol will attack some forms of plastics, rubber and coatings. It also may react with metallic aluminum at high temperatures.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If isopropyl 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. Isopropyl 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: Isopropyl 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

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

V. MISCELLANEOUS PRECAUTIONS

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

VI. COMMON OPERATIONS

Common operations in which exposure to isopropyl alcohol is likely to occur are: its use as a solvent for resins, surface coatings, adhesives, perfumes, medicinals and cosmetics; as rubbing alcohol; as de-icer for automobile windshields; as an ingredient in a variety of products; and as a chemical intermediate.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Isopropyl alcohol

D.O.L. STANDARD: 400 ppm

WARNING PROPERTIES:

Odor Threshold: Patty reports that "Scherberger et al. stated that concentration with identifiable odor of isopropyl alcohol is 200 ppm." an odor threshold of 45 ppm.

Irritation Level: According to Patty, "mild irritation of the eyes, nose, and was induced in human subjects exposed by Nelson and associates for 3 to 400 ppm of isopropyl alcohol."

Evaluation of Warning Properties: Through its odor and irritant effects, iso can be detected below or at the permissible exposure limit. For the purpose of this standard, therefore, isopropyl alcohol is treated as a material with warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 12,000 ppm

Basis for IDLH Value: This IDLH is based upon the report in Patty that "rats survive when exposed for 4 hours to the concentration of 12,000 ppm but exposure for 8 hours to this concentration resulted in death among one in the group." The Hygienic Guides note that "rats exposed to saturated ai

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mixtures of isopropanol showed only slightly toxic symptoms after 15 to minutes."

Other Toxicological Information: Patty reports that "animals subjected to va isopropyl alcohol have manifested the following signs of intoxication: mucous membranes, ataxia, prostration, deep narcosis, and death.

"Rats were unaffected except for slight intoxication when exposed intermittently over a period of a week (total number of hours of exposur given) to air apparently saturated with vapor of isopropyl alcohol. Smy rats survive when exposed for 4 hours to the concentration of 12,000 ppm exposure for 8 hours to this concentration occurred in death among one h group. Mice subjected by Neese to 10,900 ppm isopropyl alcohol in air (for about 4 hours/day until they had accumulated 123 hours of exposure w narcotized but survived. Mice died if exposed to 12,800 ppm (31.4 mg/li for 200 minutes or 19,200 ppm (47.1 mg/liter) for 160 minutes. It is wi assume that high concentrations of isopropyl alcohol would be dangerous.

"The length of time required for the development of ataxia, prost and deep narcosis on the part of mice exposed by Starrek to vapors of is were inversely proportional to the concentration. Ataxia was manifest i 26 minutes at 24,500 ppm (60 mg/liter), but it occurred with progressive decreasing rapidity at concentrations of 16,300 ppm (40 mg/liter), 12,25 (30 mg/liter), 8150 ppm (20 mg/liter), and 4100 ppm (10 mg/liter), unti 3250 ppm (8 mg/liter) 180 to 195 minutes were required. Prostration app in 37 to 46 minutes at 24,500 ppm and in 340 to 350 minutes at 3250 ppm. onset of deep narcosis ranged from 100 minutes at 24,500 ppm to 460 minu 3250 ppm. Only 1 of 12 mice exposed in these experiments succumbed. Mi exposed for 480 minutes to 2050 ppm (5 mg/liter) gave no evidence of rea

According to the Documentation of TLV's, "The most important toxi of isopropyl alcohol is narcosis. Symptomologic evidence indicates th tolerance is acquired to the narcotic effects.

"The 400 ppm value is considered to be low enough to prevent narc although slight irritation may occur."

LFL: 23,000 ppm

VAPOR PRESSURE AT 20 C: 33 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 43,400 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
ISOPROPYL ALCOHOL

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during spray application (or any other method involving heat) of surface coatings containing solvent (stain, varnish, nitrocellulose lacquers, quick-drying inks and paints, textile coatings and dyes, dopes, polishes)	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)
2.	Inhalation of vapor and skin contact with liquid during other than spray or heat - related application of surface coatings containing solvent (stain, varnish, nitrocellulose lacquers, quick-drying inks and paints, textile coatings and dyes, dopes, polishes)	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)
3.	Inhalation of vapor and skin contact with liquid during manufacture and packaging of isopropyl alcohol	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)
4.	Inhalation of vapor and skin contact with liquid during manufacture and packaging of acetone	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)
5.	Inhalation of vapor and skin contact with liquid during manufacture and packaging of surface coatings and thinners containing solvent (stain, varnish, nitrocellulose lacquers, quick-drying inks and paints, textile coatings and dyes, dopes, polishes)	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)
6.	Inhalation of vapor and skin contact with liquid during organic synthesis (isopropyl derivatives including phenols, acetates, xanthates, ether,	A,B	General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves)

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amines, myristate, palmitate,
nitrite, glycerin)

- | | | | |
|-----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----|----------------------------------------------------------------------------------------------------------------------------|
| 7. | Inhalation of vapor and skin contact with liquid in tanks during cleaning and maintenance of equipment | A,B | Self-contained breathing apparatus; personal protective equipment (rubber or impervious garments) |
| 8. | Inhalation of vapor and skin contact with liquid during manufacture and packaging of cosmetics (liniments, skin lotions, permanent wave lotions, color hair rinses) | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves) |
| 9. | Inhalation of vapor and skin contact with liquid during use (especially for medicinal purposes) of disinfectants and sanitizers (rubbing alcohol and other antiseptic solutions) | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves) |
| 10. | Inhalation of vapor and skin contact with liquid during cleaning and degreasing operations | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves) |
| 11. | Inhalation of vapor and skin contact with liquid during preparation, manufacture, and packaging of disinfectants and sanitizers (rubbing alcohol and other antiseptic solutions, skin astringents, mouth washes, and medicated sprays) | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves) |
| 12. | Inhalation of vapor and skin contact with liquid during manufacture and packaging of cleaning and degreasing agents (stain/spot remover, glass cleaner, rug and upholstery cleaner, tar remover, liquid soap, windshield cleaner fluid) | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or vinyl-coated gloves) |
| 13. | Inhalation of vapor and skin contact with liquid during manufacture and packaging of deicing, defogging, and | A,B | General dilution ventilation; personal protective equipment (goggles or face splash shield, rubber or |

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- anti-freeze products vinyl-coated gloves)
14. Inhalation of vapor and skin A,B
contact with liquid during
extraction and purification
processing (alkaloids, proteins,
chlorophyl, perfumes, sulfuric
acid, vitamins, kelp, pectin,
resins, gums, waxes)
15. Inhalation of vapor and skin A,B
contact with liquid during
manufacture of rubber products
16. Inhalation of vapor and skin A,B
contact with liquid during
use as an additive (in anti -
stalling gasoline, lubricants,
denatured ethyl alcohol,
hydraulic brake fluids, rocket
fuel
17. Inhalation of vapor and skin A,B
contact with liquid during
manufacture and use of
adhesives containing solvent
(including gasket cement,
nitrocellulose film and
microfilm cement)
18. Inhalation of vapor and skin A,B
contact with liquid during
manufacture of safety glass
- General dilution ventila-
tion; personal protective
equipment (goggles or face
splash shield, rubber or
vinyl-coated gloves)
- General dilution ventila-
tion; personal protective
equipment (goggles or face
splash shield, rubber or
vinyl-coated gloves)
- General dilution ventila-
tion; personal protective
equipment (goggles or face
splash shield, rubber or
vinyl-coated gloves)
- General dilution ventila-
tion; personal protective
equipment (goggles or face
splash shield, rubber or
vinyl-coated gloves)

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