

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** PROPYLENE DICHLORIDE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for PROPYLENE DICHLORIDE

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 PROPYLENE DICHLORIDE.

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 propylene dichloride in concentrations not in excess of 75 parts per million (ppm) (350 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 propylene dichloride.

(b) EMPLOYEE INFORMATION - Each employer who has a workplace in which propylene dichloride 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 PROPYLENE DICHLORIDE - Inform affected employees of the quantity, location, and manner of use or storage of propylene dichloride.

(c) EXPOSURE MEASUREMENT

- (1) INITIAL DETERMINATION - Each employer who has a place of employment in which propylene dichloride is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of propylene dichloride 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 propylene dichloride. 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 propylene dichloride;
 - (ii) Any measurements of airborne concentrations of propylene dichloride taken;
 - (iii) Any employee complaints of symptoms which may be attributable to exposure to propylene dichloride; 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 propylene dichloride 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 propylene dichloride 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 propylene dichloride 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 propylene dichloride 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 propylene dichloride 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 propylene dichloride 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 propylene dichloride 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) Where a fan is located in duct work and where propylene dichloride is present in concentrations greater than 8500 ppm, one fourth of the lower flammable limit, the fan rotating element 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.
 - (iii) In the design of open surface tank ventilation for the purposes of section 1910.94 (d), operations involving propylene dichloride shall be classified as B-1 at 70 F.

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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 PROPYLENE DICHLORIDE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
Equal to or less than 750 ppm	Any chemical cartridge respirator with an organic vapor cartridge(s). Any supplied air respirator. Any self-contained breathing apparatus.
Equal to or less than 1500 ppm	A gas mask with chin style or front- or back-mounted organic vapor canister. Any supplied air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 1500 ppm or escape and entry from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure -

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demand or other positive pressure or continuous -
flow mode and an auxiliary self-contained
breathing apparatus operated in pressure-demand
or other positive pressure mode.

Fire Fighting

Self-contained breathing apparatus
with a full facepiece operated in
pressure-demand or other positive pressure mode.

Escape

Any gas mask providing protection
against organic vapors.
Any escape self-contained breathing
apparatus.

(f) Fire and Safety

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

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

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

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reworn until the propylene dichloride is removed from the clothing.

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

(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 propylene dichloride may occur.

(h) Spills

- (1) Spills of propylene dichloride shall be cleaned up immediately after eliminating potential sources of ignition and utilizing available ventilation.
- (2) Liquid propylene dichloride 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 propylene dichloride promptly wash or shower using soap or mild detergent to remove any propylene dichloride from the skin.

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

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

(2) Medical -

- (I) Advise employees as to the signs and symptoms of exposure to propylene dichloride.
- (II) Instruct the employees to advise the employer of the development of signs and symptoms of exposure to propylene dichloride 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 propylene dichloride.
- (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 propylene dichloride, or airborne concentrations of propylene dichloride 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 propylene dichloride.
- (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 propylene dichloride 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 propylene dichloride.
- (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;
 - (ii) A description of the employee's duties as they relate to his exposure to propylene dichloride;
 - (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 propylene dichloride or which could significantly interfere with the ability of the employee

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to follow recommended or required procedures for protecting himself from unusual or emergency exposure.

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

(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 propylene dichloride.

(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.

(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.

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

(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 propylene dichloride 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.

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

The employer shall give affected employees or their representatives an opportunity to observe any monitoring of employee exposure to propylene dichloride which is conducted pursuant to this section.
 - (2) Exercise of opportunity to observe monitoring.
 - (i) When observation of the monitoring of employee exposure to propylene dichloride 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 propylene dichloride that are being performed at the place of exposure.
 - (c) Record the results obtained.
- (n) Employee notification.

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- (1) The employer shall notify in writing, within five work days, every employee who is found to be exposed to propylene dichloride 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: Propylene dichloride

PERMISSIBLE EXPOSURE: 75 parts of propylene dichloride per million parts of air (ppm) or 350 milligrams of propylene dichloride per cubic meter of air (mg/cu m)

APPEARANCE AND ODOR: Colorless liquid with an odor like chloroform

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: Propylene dichloride can affect your body if you inhale it or if it comes in contact with your eyes or skin, or if you swallow it.

B. Effects of Overexposure:

1. Short-Term Overexposure: Overexposure to propylene dichloride causes eye and skin irritation and may cause drowsiness or lightheadedness.
2. Long-Term Overexposure: Prolonged overexposure to propylene dichloride may affect the liver and kidneys.
3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms associated with propylene dichloride exposure.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If propylene dichloride gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If propylene dichloride gets on your skin, promptly wash the contaminated skin using soap or mild detergent. If propylene dichloride soaks through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent. If irritation persists after washing, get medical attention. Do not wear the clothing again until the propylene dichloride is removed. Replace or repair impervious clothing that has developed leaks.
- C. Breathing: If you or any other person breathes in large amounts of propylene dichloride remove the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the

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affected person warm and at rest. Get medical attention as soon as possible.

- D. Swallowing: When propylene dichloride 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 propylene dichloride. You can only be required to wear them for routine use if your employer is in the process of installing controls or if 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.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you can smell propylene dichloride 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 shield or other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid propylene dichloride.
- C. EYE PROTECTION: You must wear splash-proof safety goggles (cup cover type dust and splash safety goggles) where eye contact to liquid propylene dichloride may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

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

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- E. If your skin becomes wet with liquid propylene dichloride, you must promptly wash or shower using soap or mild detergent to remove the propylene dichloride from your skin.
- F. Clothing wet with propylene dichloride can be easily ignited. You must immediately remove any clothing that becomes wet with liquid propylene dichloride and this clothing must not be reworn until the propylene dichloride is removed from the clothing.
- G. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- H. Ask your supervisor where propylene dichloride is used in your work area and for any additional plant safety and health rules.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
PROPYLENE DICHLORIDE

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: 1,2-dichloropropane
 - 2. Formula: CH3CHClCH2Cl
 - 3. Molecular weight: 113
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 96.1 C (205 F)
 - 2. Specific gravity (water=1): 1.16
 - 3. Vapor density (air=1 at boiling point of propylene dichloride): 3.9
 - 4. Melting point: -100 C (-148 F)
 - 5. Vapor pressure at 20 C (68 F): 39.5 mm Hg
 - 6. Solubility in water, % by weight at 20 C (68 F): 0.26
 - 7. Evaporation rate (butyl acetate=1): greater than 1
 - 8. Appearance and odor: Colorless liquid with an odor like chloroform
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Flash point: 15.6 C (60 F) (closed cup)
 - 2. Autoignition temperature: 557 C (1035 F)
 - 3. Flammable limits in air, % by volume: (at 100 C)
Lower: 3.4; Upper: 14.5
 - 4. Extinguishing media: Dry chemical, foam, 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: Propylene dichloride is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where propylene dichloride is handled, used or stored. Propylene dichloride 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 propylene dichloride is handled.
 - 7. For purposes of conforming with the requirements of 29 CFR 1910.106, propylene dichloride is classified as a Class IB flammable liquid. At 8500 ppm, one-fourth of the lower flammable limit, propylene dichloride 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 propylene dichloride shall be Class I Group D.
 - B. Reactivity

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1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Strong acids may cause decomposition
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide and hydrogen chloride) may be released in a fire involving propylene dichloride.
4. Special precautions: Propylene dichloride will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

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

Propylene dichloride may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average eight-hour exposure may be determined from a single eight-hour 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 eight-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 propylene dichloride 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

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accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of propylene dichloride to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.

V. MISCELLANEOUS PRECAUTIONS

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

VI. COMMON OPERATIONS

Common operations in which exposure to propylene dichloride is likely to occur are: during its production; during its use as a paint, cleaning and spot removing agent, soil fumigant and anti-knock additive; and during its use in extraction operations, rubber vulcanization, manufacture of tetrachloroethylene and propylene oxide.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; insignificant skin absorption.

II. TOXICOLOGY

Propylene dichloride vapor is a narcotic and an eye irritant. At 2,200 ppm for 7 hours guinea pigs developed severe conjunctival swelling, as well as signs of respiratory irritation and incoordination; some died after five daily exposures, showing severe liver injury, some kidney injury, and occasional adrenal changes. Repeated inhalation of 1,000 ppm caused some deaths among dogs after 24 exposures of 7 hours duration, and among rats after only 7 exposures. There was early onset of lacrimation, eye irritation, and incoordination. Liver damage was the main finding in the animals that died. At 400 ppm, rats and guinea pigs exposed for up to 140 daily 7 hour exposures showed no ill effects and no histologic changes. However, of a group of C3H strain mice exposed at 400 ppm, some died; others developed hepatomas, a finding of equivocal significance. Propylene dichloride is mildly irritating to human skin, and some skin absorption may occur from exposure to the liquid. The undiluted liquid is moderately irritating to the eyes, but does not cause permanent injury.

III. SIGNS AND SYMPTOMS

Eye irritation from liquid splashes. May produce drowsiness and light-headedness. If overexposure is prolonged, based on animal experimentation there may be evidence of kidney or liver disease. Skin irritation may result from repeated skin contact with the liquid.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of propylene dichloride are caused by its narcotic and eye irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to propylene dichloride occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with

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chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from propylene dichloride exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- Propylene dichloride can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Liver disease -- Propylene dichloride is known as a liver toxin in animals and justifies consideration before exposing persons with impaired liver function.
3. Kidney disease -- Propylene dichloride is known as a kidney toxin in animals and justifies special consideration before exposing persons with impaired renal function.
4. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of propylene dichloride 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. American Conference of Governmental Industrial Hygienists: "Propylene Dichloride (1, 2-Dichloropropane)," (3d ed., 2d printing), Documentation of the Threshold Limit Values for Substances in Workroom Air, Cincinnati, 1974, p. 218.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1301-1303.
3. Hygienic Guide Series: "Propylene Dichloride," American Industrial Hygiene Association Journal, 28:294-296, 1967.

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4. Heppel, L.A., et al: "Toxicology of 1, 2-Dichloropropane (Propylene Dichloride) I. Studies on Effects of Daily Inhalations," Journal of Industrial Hygiene and Toxicology, 28:1-8, 1946.

5. Heppel, L.A., B. Highman and E.G. Peake: "Toxicology of 1, 2-Dichloropropane (Propylene Dichloride) IV. Effects of Repeated Exposures to a Low Concentration of the Vapor," Journal of Industrial Hygiene and Toxicology, 30:189-191, 1948.

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1910.93

- (d) Methods of Compliance - Open surface tank classification based on relative evaporation rate of 1.5 hours. A. K. Doolittle, "The Technology of Solvents and Plasticizers," John Wiley & Sons, Inc., New York, 1954, pp. 354-357.
- (e) Fire and Safety
- (1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al., National Academy of Sciences, 1973, report to U. S. Coast Guard, report no. CG-D-92-74, p. 11.
- (f) Personal Protective Equipment, and (h) Sanitation
- Eye: Documentation of TLV's; Grant, "Toxicology of the Eye"
- Skin: Documentation of TLV's; Patty, "Ind. Hyg. and Tox.:" Sax, "Dangerous Properties of Ind. Materials;" Spector, "Handbook of Toxicology"
- Ingestion: Spector, "Handbook of Toxicology;" Patty, "Ind. Hyg. and Tox."

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

The Documentation of TLV's reports that "undiluted, it is moderately irritating to the eye, but does not cause serious or permanent injury." Grant reports that "applied by drop to rabbit corneas it was found moderately injurious, resembling allyl alcohol and diethanolamine in severity." For allyl alcohol, he states "the liquid tested on rabbit eyes . . . caused . . . conjunctival edema and hyperemia with temporary clouding of the cornea, graded 5 on a scale of 1 to 10 at 24 hours." He continues that healing is usually prompt.

A classification of 2 is concluded to be appropriate.

Skin - Classification: 2

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

Exceptions: None

The Documentation of TLV's reports it is only mildly irritating to the skin. Patty agrees and adds that "single short contacts probably be without any effects. The intensity of the reaction is greatly increased when bandaged on the skin or when held close to skin by clothing." Sax considers it a chronic local irritant of moderate toxic hazard, but considers the acute and chronic effects of skin absorption to be of high toxic hazard. It is also noted that contact can cause dermatitis. Spector gives a cutaneous rabbit LD50 of 8750 mg/kg.

Propylene dichloride has a vapor pressure of 39.5 mm Hg at 20 degrees C. It is 0.26% soluble in water and has a flash point of 60 degrees F.

A classification of 2 is concluded to be appropriate to prevent the cited effects.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Spector gives an oral rat LD50 of 2.27 g/kg, a rabbit one of 1.33 g/kg, and a mouse one of 0.86 g/kg. A dog orally given 5 cc

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died in about 3 hours. Patty notes for guinea pigs that "repeated oral feedings of doses as low as 0.2 g/kg of body weight will be survived for some periods of time, but the animal will show definite injury."

Given the vapor pressure of the substance and its moderate toxicity, it is concluded that, in the context of this standard, ingestion would not present a hazard in the industrial environment.

SUBSTANCE TECHNICAL GUIDELINES

PROPYLENE DICHLORIDE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: 1,2-dichloropropane
2. Formula: CH3CHClCH2Cl
3. Molecular weight: 113

B. Physical Data

1. Boiling point (760 mm Hg): 96.1 C (205 F)
2. Specific gravity (water=1): 1.16
3. Vapor density (air=1 at boiling point of propylene dichloride): 3.9
4. Melting point: -100 C (-148 F)
5. Vapor pressure at 20 C (68 F): 39.5 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.26
7. Evaporation rate (butyl acetate=1): Greater than 1
8. Appearance and odor: Colorless liquid with an odor like chloroform

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 15.6 C (60 F) (closed cup)
2. Autoignition temperature: 557 C (1035 F)
3. Flammable limits in air, % by volume: (at 100 C)
Lower: 3.4; Upper: 14.5
4. Extinguishing media: Dry chemical, foam, 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: Propylene dichloride is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where propylene dichloride is handled, used or stored in a manner that could create a potential fire or explosion hazard. Propylene dichloride 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 propylene dichloride is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, propylene dichloride is classified as a Class IB flammable liquid. For example, 8500 ppm, approximately one-fourth of the lower flammable limit, is one situation in which propylene dichloride is considered to be a potential fire and explosion hazard.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article

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500 of the National Electrical Code for propylene dichloride shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions. Strong acids may cause decomposition.
3. Hazardous decomposition products: Toxic gases and vapors (such as carbon monoxide and hydrogen chloride) may be released in a fire involving propylene dichloride.
4. Special precautions: Propylene dichloride will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

A. If propylene dichloride is spilled or leaked, the following steps should be taken:

1. Remove all ignition sources
2. Ventilate area of spill or leak
3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for vapors to completely clear hood duct work, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. Propylene dichloride may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.
4. Wash site of spill or leak with soap solution.

B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

C. Waste disposal methods: Propylene dichloride may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

IV. MONITORING AND MEASUREMENT PROCEDURES

- a. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average eight-hour exposure may be determined from a single eight-hour 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 eight-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 propylene dichloride to plus or minus 35%.

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- b. EXPOSURE ABOVE THE PERMISSIBLE EXPOSURE: The monitoring under this section should be essentially the same as described under paragraph IV. a. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of propylene dichloride to plus or minus 25%. Methods meeting these accuracy requirements are available from NIOSH.
- V. MISCELLANEOUS PRECAUTIONS
- A. Store propylene dichloride in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to propylene dichloride can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close heated metal propylene dichloride 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 propylene dichloride could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to propylene dichloride is likely to occur are: During its production; during its use as a paint, cleaning and spot removing agent, soil fumigant and anti-knock additive; and during its use in extraction operations, rubber vulcanization, manufacture of tetrachloroethylene and propylene oxide.

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Propylene dichloride

D. O. L. STANDARD: 75 ppm

WARNING PROPERTIES:

Odor Threshold: Staub reports an odor threshold of 50 ppm. The AIHA Hygiene Guides state that "human subjects described the odor as 'strong' at 130 to 190 ppm and 'not noticeable' at 15 to 23 ppm."

Eye Irritation Level: According to Grant, "exposure of guinea pigs to 2,200 ppm in air for many hours until most were dead caused lacrimation and swelling of the lids and conjunctiva. To the extent that the corneas were left unprotected, bluish discoloration of the corneas and infection developed. Rabbits exposed to the same conditions showed little irritation." No quantitative information is available concerning the threshold of eye irritation, but half-facepiece respirators are permitted up to 400 ppm, no ill effects have been observed in animals chronically exposed to 400 ppm.

Evaluation of Warning Properties: Since the odor threshold of propylene dichloride is below the permissible exposure limit, this substance is treated as a material with adequate warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 2000 ppm

Basis for IDLH Value: This IDLH is based upon the 4-hour rat LC50 of 2000 ppm reported by Spector.

Other Toxicological Information: Spector gives a 4-hour rat LC50 of 2000 ppm for propylene dichloride. An LD100 for mice given Spector is 2200 ppm with death occurring in less than 7 hours' exposure.

Patty states that "At a concentration of 1000 ppm in air, dogs were exposed 7 hours/day, 5 days/week. Some deaths were observed after 24 exposures. There were some deaths in guinea pigs after 22 exposures. Rats succumbed

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in as few as 7 exposures. Rabbits survived this concentration for some of time. The same authors exposed rats, guinea pigs, and dogs to 400 ppm. They were exposed 7 hours/day, 5 days/week for periods of 128 to 140 exposures. These investigators saw no ill-effects and no histological changes in the animals."

According to the AIHA Hygienic Guides, "exposures of rats to essentially saturated vapor killed six of six in one hour, three of six in 30 minutes and one of six in 15 minutes."

The Hygienic Guides state that the IDLH is unknown for humans but "injuries and fatalities have not been reported from exposures to propylene dichloride despite widespread industrial use." The Guides note that "available data indicate propylene dichloride to be less toxic than carbon tetrachloride but more toxic than ethylene chloride."

LFL (at 100 C): 34,000 ppm

VAPOR PRESSURE AT 20 C: 39.5 mm Hg

SATURATED CONCENTRATION AT 20 C: Approximately 52,000 ppm

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USE/EXPOSURE AND CONTROL DOCUMENT
PROPYLENE DICHLORIDE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and contact with liquid during use as a soil fumigant (protection against nematodes for fruit and nut crops, including pineapple and citrus; vegetable and field crops, including sugar beets and tobacco)	A,B	Adequate ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
2.	Inhalation of vapor and contact with liquid during cleaning, degreasing, and spot removal operations (including paint and varnish removal)	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
3.	Inhalation of vapor and contact with liquid during rubber compounding and vulcanizing operations	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
4.	Inhalation of vapor and contact with liquid during extraction processing (fats, oils, lactic acid, petroleum waxes)	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
5.	Inhalation of vapor and contact with liquid during manufacture of substance	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
6.	Inhalation of vapor and contact with liquid during manufacture of tetrachloroethylene	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
7.	Inhalation of vapor and contact with liquid during manufacture of propylene oxide	A,B	Local exhaust ventilation; personal protective equipment (goggles, rubber clothing, respiratory protective devices)
8.	Inhalation of vapor and contact with liquid during	A,B	Local exhaust ventilation; personal protective equip-

II

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use as an additive (lead
scavenger) in anti-knock
fluids

ment (goggles, rubber
clothing, respiratory
protective devices)

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

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

1,297 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

