

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** 1,1,2,2-TETRACHLOROETHANE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for 1,1,2,2-TETRACHLOROETHANE

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 1,1,2,2-TETRACHLOROETHANE.

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

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

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(a) Definitions.

(1) "Permissible exposure" means inhalation of 1,1,2,2-tetrachloroethane in concentrations not in excess of 5 parts per million (ppm) (35 milligrams per cubic meter, mg/m³) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one half of the permissible exposure for 1,1,2,2-tetrachloroethane.

(b) Exposure determination and measurement.

(1) Each employer who has a place of employment in which 1,1,2,2-tetrachloroethane is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of 1,1,2,2-tetrachloroethane 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 1,1,2,2-tetrachloroethane.

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

(i) Any information, observations, or calculations which may indicate employee exposure to 1,1,2,2-tetrachloroethane;

(ii) Any measurements of 1,1,2,2-tetrachloroethane taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to 1,1,2,2-tetrachloroethane; and

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

(3) If the employer determines that any employee may be exposed to 1,1,2,2-tetrachloroethane at or above the action level, the exposure of the employee in each work operation who is believed to have the greatest exposure shall be measured. The exposure measurement shall be representative of the maximum eight-hour time weighted average exposure of the employee.

(4) If the exposure measurement taken pursuant to paragraph (b) (3) of this section reveals employee exposure to 1,1,2,2-tetrachloroethane at or above the action level, the employer shall:

(i) Identify all employees who may be exposed at or above the action level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to 1,1,2,2-tetrachloroethane at or above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every two months.

(6) If an employee exposure measurement reveals that an employee is exposed to 1,1,2,2-tetrachloroethane above the permissible exposure, the employer shall:

(i) Measure the exposure monthly of the employee so exposed; and

(ii) Institute control measures as required by paragraph (D) of this section; and

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to 1,1,2,2-tetrachloroethane above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

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(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to 1,1,2,2-tetrachloroethane below the action level, the employer may terminate measurement for the employee.

(8) For purposes of this paragraph, employee exposure is that which would occur if the employee were not using a respirator.

(c) Methods of measurement.

(1) An employee's exposure shall be obtained by any combination of long term or short term samples which represents the employee's actual exposure averaged over an eight-hour work shift (See Appendix B (iv) of this section).

(2) The method of measurement shall have an accuracy, to a confidence level of 95%, of not less than that given in Table 1.

Table 1

Concentration	Required Accuracy
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Above permissible exposure	$\pm 25\%$
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At or below permissible exposure	
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and above the action level	$\pm 35\%$
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At or below the action level	$\pm 50\%$
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(d) Compliance. (1) No employee shall be exposed to 1,1,2,2-tetrachloroethane above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of 1,1,2,2-tetrachloroethane shall be controlled to at or below the permissible exposure by engineering and work practice controls:

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not technically feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d)(4) of this section.

(3) Engineering controls. (i) When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of 1,1,2,2-tetrachloroethane.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving 1,1,2,2-tetrachloroethane shall be classified as A-2 at 70 degrees F.

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(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

(ii) In work situations in which engineering and work practice controls are technically not feasible; or

(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of 1,1,2,2-tetrachloroethane to at or below the permissible exposure; or

(iv) For operations which require entry into tanks or closed vessels; or

(v) In emergencies.

(5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee uses the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR 1,1,2,2 - TETRACHLOROETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
50 ppm or less	A chemical cartridge respirator with an organic vapor cartridge(s).
	Any supplied-air respirator.
	Any self-contained breathing apparatus.
150 ppm or less	A chemical cartridge respirator with a full facepiece and organic vapor cartridge(s).
	A gas mask with a chin-style or a front- or back-mounted organic vapor canister.
	Any supplied-air respirator with a full facepiece, helmet or hood.
	A Type C supplied-air respirator with a half-facepiece operated in pressure-demand or other positive pressure or continuous-flow mode.
	Any self-contained breathing apparatus with a full facepiece.
Greater than 150 ppm or entry and escape from unknown concen-	Self-contained breathing apparatus with a full facepiece operated in pressure demand or other positive pressure mode.

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trations A combination respirator which includes
a Type C supplied-air respirator with
a full facepiece operated in pressure -
demand or other positive pressure or
continuous-flow mode and an auxiliary
self-contained 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.

(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

(e) Fire and safety. (1) The employer shall familiarize himself with the information contained in the Substance Technical Guidelines (Appendix B of this section) for 1,1,2,2-tetrachloroethane.

(2) 1,1,2,2-Tetrachloroethane shall be stored so as not to come in contact with chemically active metals.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent any possibility of skin contact with liquid 1,1,2,2-tetrachloroethane. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that clothing contaminated with liquid 1,1,2,2-tetrachloroethane is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of 1,1,2,2-tetrachloroethane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,1,2,2-tetrachloroethane, the employer shall inform the person performing the operation of the hazardous properties of 1,1,2,2-tetrachloroethane.

(3) Where exposure of an employee's body to liquid 1,1,2,2-tetrachloroethane may occur, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(4) Employers shall ensure that non-impervious clothing which becomes contaminated with liquid 1,1,2,2-tetrachloroethane be removed immediately and not reworn until the 1,1,2,2-tetrachloroethane is removed from the clothing.

(5) Employers shall provide and ensure that employees use splash-proof safety goggles (cup-cover type dust and splash safety goggles) which comply

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with § 1910.133(a)(2)-(a)(6) where there is any possibility of liquid 1,1,2,2-tetrachloroethane contacting the eyes.

(6) Where there is any possibility that an employee's eyes may be exposed to liquid 1,1,2,2-tetrachloroethane, employers shall provide an eye-wash fountain within the immediate work area for emergency use.

(g) Spills and disposal. In the event that liquid 1,1,2,2-tetrachloroethane is spilled the employer shall immediately provide available ventilation and then clean up the spill.

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes contaminated with liquid 1,1,2,2-tetrachloroethane immediately wash or shower with soap or mild detergent and water to remove any 1,1,2,2-tetrachloroethane from the skin.

(2) Employers shall ensure that employees do not eat or smoke in areas where liquid 1,1,2,2-tetrachloroethane is handled, processed or stored.

(3) Employers shall ensure that employees who handle liquid 1,1,2,2-tetrachloroethane wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

(i) Training and information. (1) Each employer who has a workplace in which 1,1,2,2-tetrachloroethane is present shall keep a copy of this regulation with Appendixes A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to 1,1,2,2-tetrachloroethane above the action level or employees who may have skin or eye contact with liquid 1,1,2,2-tetrachloroethane, or employees who work where an accidental spill of 1,1,2,2-tetrachloroethane may occur, shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for 1,1,2,2-tetrachloroethane (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to 1,1,2,2-tetrachloroethane.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to 1,1,2,2-tetrachloroethane which are listed in Appendix A of the section; and

(iv) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to 1,1,2,2-tetrachloroethane.

(j) Medical surveillance. (1) The employer shall provide medical procedures as required by this paragraph. All medical procedures shall be performed by or under the supervision of a physician at no cost to the employee.

(2) The employer shall make available to each employee who is to be exposed to liquid 1,1,2,2-tetrachloroethane or airborne concentrations of 1,1,2,2-tetrachloroethane at or above the action level, without regard to the use of respirators, a medical examination which shall include the following:

(i) A medical history and physical examination with emphasis on the liver, kidneys and central nervous system.

(ii) A profile of liver function.

(iii) Urinalysis to include specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

(3) The employer shall obtain from the physician, as a record of the examination, the following information:

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(i) A written opinion which conforms with paragraph (j)(7) of this section.

(ii) A record of the results of liver function tests.

(iii) A record of the results of the urinalysis.

(4) The employer shall make available to each employee, exposed to 1,1,2,2-tetrachloroethane in excess of the action level at 12 months from the date of the employee's first exposure, and at every 12 months of exposure in excess of the action level thereafter, a medical examination which must include the following:

(i) A medical history and physical examination (see paragraph (j)(2)(i) of this section).

(ii) Tests of liver function (see paragraph (j)(2)(ii) of this section).

(iii) Urinalysis (see paragraph (j)(2)(iii) of this section).

(5) The employer shall obtain from the physician, as a record of the periodic examination, the following information:

(i) A written opinion which conforms with paragraph (j)(7) of this section.

(ii) A record of the results of liver function tests..

(iii) A record of the results of the urinalysis.

(6) The employer shall provide to the examining physician the following information:

(i) A copy of this regulation with its Appendixes A, B, and C for 1,1,2,2-tetrachloroethane;

(ii) A description of the employee's duties as they relate to his exposure to 1,1,2,2-tetrachloroethane;

(iii) A description of any personal protective equipment and respirators required to be used;

(iv) The results of any measurement which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure; and

(vi) Upon request of the physician, any available information from previous medical examination of the affected employee.

(7)(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 would place the employee at increased risk of material impairment of the employee's health from exposure to 1,1,2,2-tetrachloroethane or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to 1,1,2,2-tetrachloroethane, including limitations upon the use of personal protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnosis unrelated to exposure to 1,1,2,2-tetrachloroethane.

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

(8) No employee shall be exposed to liquid 1,1,2,2-tetrachloroethane or airborne concentrations of 1,1,2,2-tetrachloroethane in such a way as would put the employee at increased risk of material impairment of his health from such exposure. This determination may be based on the physician's written opinion.

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(9) The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to 1,1,2,2-tetrachloroethane.

(10) If the examining physician chooses to use alternative medical examinations to those specified in paragraphs (j)(2) and (4) of this section, the employer may accept such alternative medical surveillance examinations as meeting the requirements of this part provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for substitution and evidence that they will be equally effective.

(ii) Informs each exposed employee of the fact that alternative medical examinations to those required in paragraphs (j)(2) or (4) of this section are to be made available.

(11) 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.

(k) Recordkeeping. (1) Exposure determination. (i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) The record shall include the written determination required in paragraph (b)(2) of this section.

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

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to 1,1,2,2-tetrachloroethane.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,1,2,2-tetrachloroethane which are being monitored;

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

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

(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

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(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

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

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) The record shall include:

(A) Results of tests required by paragraph (j)(2) and (j)(5) of this section;

(B) Any employee medical complaints relative to exposure to 1,1,2,2-tetrachloroethane;

(C) A copy of information provided to the physician pursuant to paragraph (j)(6)(ii), (iii), (iv), (v), and (vi) of this section.

(D) Physician's written opinion; and

(E) A signed statement of any refusal to be examined.

(iii) This record shall be maintained for the duration of the employment of the affected employee.

(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.

(ii) Employee exposure determination and exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.

(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.

(1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to 1,1,2,2-tetrachloroethane which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to 1,1,2,2-tetrachloroethane requires entry into an area where the use of personal protective devices, including respirators, is required, the observer shall be provided with and required to use such equipment and comply with all other applicable safety procedures.

(3) Without interfering with the measurement, observers shall be entitled to:

(i) Receive an explanation of the measurement procedure.

(ii) Visually observe all steps related to the measurement of the airborne concentration of 1,1,2,2-tetrachloroethane that are being performed at the place of exposure; and

(iii) Record the results obtained.

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

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR 1,1,2,2-TETRACHLOROETHANE

I. SUBSTANCE IDENTIFICATION

- A. Substance: 1,1,2,2-Tetrachloroethane
- B. Permissible Exposure: 5 parts of 1,1,2,2-tetrachloroethane vapor per million parts of air (ppm) or 35 milligrams of 1,1,2,2-tetrachloroethane vapor per cubic meter of air (mg/m³) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless or pale yellow liquid with sweet odor like that of chloroform.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: 1,1,2,2-Tetrachloroethane can affect your body if you inhale it or if it comes in contact with your eyes or skin or if you swallow it. It may be absorbed through the skin.
- B. Effects of Overexposure:
 - 1. Short-Term Exposure: Breathing in high concentrations of 1,1,2,2-tetrachloroethane may cause irritation of the eyes and nose, nausea, vomiting and drowsiness. Liver and kidney damage may occur. If the exposure was severe, within a few hours a deep dusky coloration of the skin may appear followed by unconsciousness and death. If the exposed worker is removed immediately, he may recover completely but should be placed under observation in case late symptoms appear. If the vapor or liquid of 1,1,2,2-tetrachloroethane gets in your eyes, it may cause watering and burning. It may cause serious eye damage unless immediate medical care is obtained.
 - 2. Long-Term Exposure: Prolonged or repeated exposure to 1,1,2,2-tetrachloroethane, either by breathing or by absorbing it through the skin, may cause fatigue, tremors, loss of appetite, weight loss, constipation, heart damage, blood changes, kidney damage, abdominal distress or pain, vomiting, dizziness, tenderness, liver damage with such symptoms as pain over the liver, dark urine, and yellow jaundice. Prolonged or repeated skin contact with 1,1,2,2-tetrachloroethane may also cause skin irritation.
 - 3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to 1,1,2,2-tetrachloroethane.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If 1,1,2, 2-tetrachloroethane gets into your eyes, wash your eyes immediately with large amounts of water.

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lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.

- B. Skin Exposure: If 1,1,2,2-tetrachloroethane gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,1,2,2-tetrachloroethane soaks through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of 1,1,2,2-tetrachloroethane, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When 1,1,2,2-tetrachloroethane 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 1,1,2,2-tetrachloroethane. You can only be required to wear them for routine use if your employer is in the process of installing controls or control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) or National Institute for Occupational Safety and Health (NIOSH) approval label. (Older respirators may have a Bureau of Mines approval label.) For effective protection, respirators must fit your face and head snugly. Respirators should not be loosened or removed in work situations where their use is required. If you can smell 1,1,2,2-tetrachloroethane 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 any possibility of skin contact with liquid 1,1,2,2-tetrachloroethane. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) if there is

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any possibility of liquid 1,1,2,2-tetrachloroethane contacting your eyes

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. 1,1,2,2-Tetrachloroethane must be stored in tightly closed containers in a well ventilated area away from chemically active metals, such as sodium and potassium, caustics, hot iron, aluminum, and zinc.
- B. If your skin becomes contaminated with liquid 1,1,2,2-tetrachloroethane, you must immediately wash or shower using soap or mild detergent and water to remove any 1,1,2,2-tetrachloroethane from the skin.
- C. You must promptly remove any non-impervious clothing that becomes contaminated with liquid 1,1,2,2-tetrachloroethane and the clothing must not be reworn until the 1,1,2,2-tetrachloroethane is removed from the clothing.
- D. You must not eat or smoke in areas where liquid 1,1,2,2-tetrachloroethane is handled, processed or stored.
- E. If you handle liquid 1,1,2,2-tetrachloroethane, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- F. Eye flushing facilities and quick drenching facilities, where provided, must be readily available and you should know where they are and how to operate them.
- G. Ask your supervisor where 1,1,2,2-tetrachloroethane is used in your work area and for any additional plant safety and health rules.

VI. ACCESS TO INFORMATION

- A. Each year your employer is required to inform you of the information contained in this Substance Safety Data Sheet for 1,1,2,2-tetrachloroethane. In addition, your employer must instruct you in the safe use of 1,1,2,2-tetrachloroethane, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to 1,1,2,2-tetrachloroethane. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR 1,1,2,2-TETRACHLOROETHANE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Symmetrical-tetrachloroethane; acetylene tetrachloride, sym-tetrachloroethane
2. Formula: CHCl2CHCl2
3. Molecular weight: 167.8

B. Physical Data

1. Boiling point (760 mm Hg): 146 C (295 F)
2. Specific gravity (Water = 1): 1.6
3. Vapor density (air = 1 at boiling point of 1,1,2,2-tetrachloroethane): 5.8
4. Melting point: -42.5 C (-44.5 F)
5. Vapor pressure at 20 C (68 F): 8 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.29
7. Evaporation rate (butyl acetate = 1): 0.65
8. Appearance and odor: Colorless or pale yellow liquid with a sickly sweet odor like chloroform.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Not combustible

B. Reactivity

1. Conditions contributing to instability: Heat; unusual exposure to light in the presence of air may form small amounts of phosgene.
2. Incompatibilities: Reacts with chemically active metals or with strong caustics. In the presence of steam, contact with hot iron, aluminum, and zinc may cause formation of toxic vapors.
3. Hazardous decomposition products: Toxic gases and vapors (such as phosgene, hydrogen chloride, chlorinated solvents and carbon monoxide) may be formed when 1,1,2,2-tetrachloroethane decomposes.
4. Special precautions: Liquid 1,1,2,2-tetrachloroethane will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If 1,1,2,2-tetrachloroethane is spilled or leaked, the following steps should be taken:

1. Ventilate area of spill or leak.
2. Collect for reclamation or absorb in vermiculite, dry sand, earth or a similar material.

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

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- C. Waste disposal methods: 1,1,2,2-Tetrachloroethane may be disposed of by absorbing in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. Exposure above the action level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Several short time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84. Portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of 1,1,2,2-tetrachloroethane to plus or minus 35%.
- B. Exposure above the permissible exposure: The monitoring and measurements under this section should be essentially the same as described under paragraph (IV)(A). Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of 1,1,2,2-tetrachloroethane to plus or minus 25%.
- C. Methods: Methods meeting the above accuracy requirements are available from NIOSH.
- D. Qualified Persons: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store 1,1,2,2-tetrachloroethane in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to 1,1,2,2-tetrachloroethane can occur when transferring the liquid from one container to another.
- C. Employers should advise employees of all areas and operations where exposure to 1,1,2,2-tetrachloroethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,1,2,2-tetrachloroethane is likely to occur are: during its use as an intermediate in the synthesis of trichloroethylene and other chlorinated solvents; as a fumigant; in the manufacture of lacquers, varnishes, and paint removers; cyanogen and chlorine polymers; in the preparation and use of insecticides and weed killers; as a degreaser and cleaning agent; in the preparation of adhesives; in the refining of waxes and

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resins; and during the chlorination of phthalic anhydride and the production of 1,1,2,2-tetrachloroethane.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

1,1,2,2-Tetrachloroethane is highly toxic to the liver and a central nervous system depressant. Rats exposed to 500 ppm for 4 hours survived, but 1,000 ppm was fatal. Reports of industrial experience indicate that cases of mild intoxication have presented symptoms of gastrointestinal irritation (nausea, vomiting, abdominal pain, anorexia) and central nervous system effects (dizziness, headache, irritability, nervousness, insomnia); more severe exposure resulted in liver involvement (liver enlarged and tender, jaundice, bilirubinuria), nephritis (albuminuria and casts), and tremors of hands and eyelids. In cases of severe industrial intoxication, there was hepatic necrosis with jaundice, sometimes progressing to cirrhosis; individuals who died during the acute stage also showed cerebral edema and pulmonary edema with hemorrhage, as well as liver and kidney injury. One study reported that human subjects exposed to 335 ppm for 10 minutes or 186 ppm for 30 minutes noted a disagreeable odor; there were some upper respiratory irritation and central nervous system effects. Among a group of workers in India exposed to 20-65 ppm there was nausea, vomiting, and abdominal pain and a high incidence of tremor of the fingers. Prolonged skin exposure may be expected to produce dermatitis due to defatting action. Severe eye effects have been reported.

III. SIGNS AND SYMPTOMS

Nausea, vomiting, abdominal pain; tremor of the fingers; jaundice with enlargement and tenderness of liver; may produce dermatitis from prolonged exposure; monocytosis; possible kidney damage.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes with water and wash skin with soap and 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

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Most reported effects of 1,1,2,2-tetrachloroethane are caused by its central nervous system toxicity and its capacity to irritate the gastrointestinal tract and damage the liver and kidneys. It has no significant warning properties. Many human cases have been reported. It is important that the physician becomes familiar with plant operating conditions in which exposure to 1,1,2,2-tetrachloroethane occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

The following medical procedures must be made available to each employee who is exposed to 1,1,2,2-tetrachloroethane:

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of liver, kidneys and central nervous system should be stressed.
2. Liver function tests -- 1,1,2,2-Tetrachloroethane causes liver damage. A profile of liver function shall be obtained by utilizing a medically acceptable array of biochemical tests.
3. Urinalysis -- Since kidney damage has also been observed from exposure, a urinalysis shall be obtained to include at a minimum specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

References

1. American Conference of Governmental Industrial Hygienists: "1,1,2,2-Tetrachloroethane," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 249-250.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1292-1294.
3. von Oettingen, W. F.: The Halogenated Aliphatic, Olefinic, Cyclic, Aromatic, and Aliphatic-Aromatic Hydrocarbons Including the Halogenated

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Insecticides, Their Toxicity and Potential Dangers, U.S. Public Health Service Publication No. 414, U.S. Government Printing Office, Washington, D.C., 1955, pp. 158-164.

4. Lobo-Mendonca, R.: "Tetrachloroethane--A Survey," British Journal of Industrial Medicine, 20:50-56, 1963.

5. Manufacturing Chemists Association: "Chemical Safety Data Sheet SD-34, Tetrachloroethane," Washington, D.C., 1949, pp. 11-14.

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REFERENCES AND SOURCES
1,1,2,2 - TETRACHLOROETHANE
1910.93

- (d) Compliance - Open surface tank classification based on relative evaporation rate of 12 hours (from Doolittle).
(f) Personal Protective Equipment, and, (h) Sanitation
Eye: Grant, "Toxicology of the Eye;" Manufacturing Chemists Association, Chemical Safety Data Sheet, "Tetrachloroethane"
Skin: Manufacturing Chemists Association, Chemical Safety Data Sheet, "Tetrachloroethane;" Browning, "Toxicity and Metabolism of Industrial Solvents"
Ingestion: Manufacturing Chemists Association, Chemical Safety Data Sheet, "Tetrachloroethane;" Browning, "Toxicity and Metabolism of Industrial Solvent;" Patty, "Industrial Toxicity;" Gleason, "Clinical Toxicology of Commercial Products"

COMMENTS

Eye - Classification: 1

Output statement numbers: 9, 13

Exceptions: None

Grant states that "there appear to have been no eye injuries reported . . . , but splash in the eye would presumably cause transient epithelial injury similar to that caused by chloroform;" under the latter chemical, injury is described as "immediate burning pain, tearing and reddening of the conjunctiva." MCA reports that this specific compound irritates the eyes producing "lacrimation, burning, and other symptoms of inflammation; it can cause serious eye damage if immediate care is neglected." It is concluded that eye effects can be serious. Grant "presumes" its effects while MCA states them positively.

Skin - Classification: 1

Output statement numbers: 1, 7a, 8b, 14g, 14i, 20a

Exceptions: Statements 6 and 8a are too stringent and are replaced by 7a and 8b, respectively.

MCA reports that this compound is absorbed through the skin and systemic poisoning (nausea, dizziness, weight loss, etc) may occur. Dermatitis will result from repeated or prolonged contact. Reddening, burning and rarely blisters may result from repeated exposure, according to MCA. A rabbit LD50 by subcutaneous injection is "50 ul, but if dissolved in propylene glycol 26 uL/kg and when dissolved in normal rabbit serum only 24 uL/kg," according to Browning. The intraperitoneal LD for mice is 0.2 ml. Its vapor pressure at 20 C is 8 mm Hg. The LD50's given are so low, and so many fatal cases have been noted in the literature, some of which might be attributable to skin contact, that the substance is concluded to have severe acute effects. Since the substance is not corrosive, statement 8b is used to apply only where skin contact may occur.

Ingestion - Classification: 1

Output statement numbers: 19, 20a

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Exceptions: None

According to MCA, tetrachloroethane is "absorbed very rapidly and even a small amount may go on to produce unconsciousness and a deep flushing of the skin." An oral MDL within 24 hours for dogs has been found to be 0.70 g/kg, the actual dose being 4.2 g, as reported in Browning. Patty reports a nonfatal case of human ingestion of 3 ml which resulted in coma, weak pulse and shallow respiration; Gleason states that "severe mucosal injury and often liver necrosis" may result from ingestion. Given the effects of only a 3 ml ingestion by a human, it is concluded that it is possible for there to be harmful exposures by ingestion in an industrial setting.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

Manufacturing Chemists Association, Chemical Safety Data Sheet SD-34 (1949) (MCA)

Hooker Chemical Corp., Data Sheet No. 852 (Hook)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 5, p. 159 (K-O)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 1st edition, Vol. 12, p. 679 (K-O-1)

Sources of data items used:

- I. A. 1. Synonyms: MCA; K-O
- 2. Formula: MCA; Hook
- 3. Molecular weight: ADL
- B. 1. Boiling point: MCA
- 2. Specific gravity: MCA; Hook; K-O
- 3. Vapor density: MCA
- 4. Melting point: MCA
- 5. Vapor pressure: MCA; K-O
- 6. Solubility in water: K-O
- 7. Evaporation rate: K-O-1
- 8. Appearance and odor: MCA; K-O
- II. B. 1. Conditions contributing to instability: K-O
- 2. Incompatibilities: MCA; K-O
- 3. Hazardous decomposition products: K-O
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: ADL
- C. Waste disposal method: MCA; ADL
- V. Miscellaneous precautions: MCA

USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of this document include:

American Conference of Governmental Industrial Hygienists, "Documentation of Threshold Limit Values," 1971 (ACGIH)

-Faith, W. L., Keyes, D. P. and Clark, R. E., "Industrial Chemicals," John Wiley, Inc., 1965 (Faith)

Hawley, G. G., "The Condensed Chemical Dictionary," Van Nostrand Reinhold, Co., New York, 1971 (Hawley)

International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)

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- Kirk, R. E. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 2nd edition, 1972 (K-O)
- Kirk, R. E. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 1st edition, 1954 (Chem Tech)
- Mellan, I., "Source Book of Industrial Solvents," Vol. II, "Halogenated Hydrocarbons," Reinhold Publishing Corp., 1957 (Mellan)
- Patty, F. A., "Industrial Hygiene and Toxicology," Interscience Publishers, 1962 (Patty)
- Plunkett, E. R., "Handbook of Industrial Toxicology," Chemical Publishing Co., Inc., 1966 (Plunkett)

References for Specific Use/Exposure

1. ILO, Chem Tech, Hooker, Faith
2. Patty
3. K-O
4. K-O, Mellan
5. K-O
6. K-O
7. Mellan, Hawley
8. Mellan, Hawley
9. Hawley
10. Hawley
11. Chem Tech
12. Mellan, Hawley
13. Mellan, Hawley
14. Hawley

References for Specific Control Methods

ILO and Plunkett were the references used for the Specific Control Methods in numbers 1 - 14.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 5 ppm.

WARNING PROPERTIES: Patty states that the odor of 1,1,2,2 - tetrachloroethane is detectable at 5 ppm (3 ppm, according to Lehmann). Since the odor threshold is at (or below) the permissible exposure limit, 1,1,2,2 - tetrachloroethane is treated as a material with good warning properties, and gas sorbent respiratory equipment is permitted.

EYE IRRITATION: Grant indicates that 1,1,2,2 - tetrachloroethane is not an eye irritant.

LFL: 1,1,2,2 - tetrachloroethane is not flammable.

IDLH: 150 ppm.

IDLH BASIS: Based upon Spector's report that a 30-minute exposure to 146 ppm caused vertigo in humans, an IDLH concentration of 150 ppm 1,1,2,2 - tetrachloroethane is assumed for the purposes of this standard.

SUMMARY OF TOXICOLOGY:

Browning states that tetrachloroethane is a potent narcotic and -hepatotoxin. It exerts an acute anesthetic effect which is 4 times greater than that of chloroform. Repeated exposures can produce "severe toxic hepatitis" which often results in death. In addition, gastrointestinal symptoms are present in the "more severe and advanced stage(s) of intoxication."

Patty also notes that "dizziness, nervousness, and incoordination"

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can result from acute exposure to 1,1,2,2, - tetrachloroethane, and unconsciousness and death can result from severe acute exposures. Patty points out, however, that "central nervous system depression is not a striking part of the response to usual industrial exposure because of the low volatility and other injurious effects predominating at lower levels." According to Patty, respiratory irritation may be followed by lung injury.

Patty states that Lehmann and Schmidt-Kehl reported the odor of 1,1,2,2 - tetrachloroethane to be noticeable at 3 ppm. According to Patty, however, the accepted level at which the odor can be detected is 5 ppm.

Several investigators found that acute exposures to concentrations ranging between 3000 ppm and 5800 ppm tetrachloroethane caused death in mice. No deaths in cats, however, resulted from acute exposures to 8300 ppm.

Spector reports a minimum lethal concentration of 5350 ppm for mice for a 2-hour exposure, and a lethal concentration of 4000 ppm for a 115-minute continuous exposure.

Spector also notes that humans exposed to 146 ppm for 30-minutes experienced "irritation of mucous membranes, sense of pressure in head, vertigo, (and) fatigue." These same symptoms were produced in humans by exposures to 335 ppm for 10 minutes. No ill effects were produced by 13 ppm for 10 minutes.

Patty states that one investigator indicated that 1,1,2,2 - tetrachloroethane could be absorbed through the skin. No data concerning the absorption of this substance through intact skin are available, however.

Grant reports that no eye injury was observed in dogs repeatedly exposed to vapors of tetrachloroethane.

VAPOR PRESSURE AT 20 C: 8 mm.

SATURATED AIR CONCENTRATION: 10,500 ppm.

Saturated air at 20 C contains approximately 10,500 ppm
1,1,2,2-tetrachloroethane.

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Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid during use as an intermediate in the production of tetrachloroethylene and trichloroethylene	A,B,D	Local exhaust ventilation; general dilution ventilation
2. Inhalation of vapor and skin contact with liquid during use in cleaning and extraction processes	A,B,D	Local exhaust ventilation; general dilution ventilation
3. Inhalation of vapor and skin contact with liquid during the chlorination of phthalic anhydride	A,B,D	Local exhaust ventilation; general dilution ventilation
4. Inhalation of vapor and skin contact with liquid during the production of 1,1,2,2-tetrachloroethylene by the chlorination of ethylene or ethane	A,B,D	Local exhaust ventilation; general dilution ventilation
5. Inhalation of vapor and skin contact with liquid during use in the manufacture of cyanogen chloride polymers and tetra-chloroalkylphenol	A,B,D	Local exhaust ventilation; general dilution ventilation
6. Inhalation of vapor and skin contact with liquid during the use as a fumigant in greenhouses	A,B,D	Personal protective equipment (goggles, respiratory devices, gloves, protective clothing); natural ventilation
7. Inhalation of vapor and skin contact with liquid during the manufacture and use of lacquers and varnishes	A,B,D	Process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, respiratory protective devices)
8. Inhalation of vapor and skin contact with liquid during the manufacture and use of paint and	A,B,D	Process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles,

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varnish removers

respiratory protective devices)

- | | | | |
|-----|--|-------|--|
| 9. | Inhalation of vapor and skin contact with liquid during the preparation and use of insecticides and weed killers | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles, respiratory protective devices) |
| 10. | Inhalation of vapor and skin contact with liquid during the cleaning and degreasing of metals | A,B,D | Process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles) |
| 11. | Inhalation of vapor and skin contact with liquid during use as a solvent in the preparation of adhesives | A,B,D | Local exhaust ventilation |
| 12. | Inhalation of vapor and skin contact with liquid during use of adhesives containing 1,1,2,2-tetrachloroethane | A,B,D | General dilution ventilation; personal protective equipment (gloves) |
| 13. | Inhalation of vapor and skin contact with liquid during addition to aliphatic alcohols and acetates to improve solvency for nitrocellulose and cellulose acetate (as in photographic film) | A,B,D | Local exhaust ventilation |
| 14. | Inhalation of vapors and skin contact with liquid during use in refining of waxes and resins | A,B,D | Local exhaust ventilation |

A -- Inhalation

B -- Skin contact resulting in localized irritation

C -- Ingestion

D -- Skin contact resulting in absorption and subsequent systemic poisoning

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

1,306 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

