

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** 1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE ***

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

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-TETRACHLORO-1,2-DIFLUOROETHANE.

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.

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

(a) Definitions.

(1) "Permissible exposure" means inhalation of 1,1,2,2-tetrachloro-1,2-difluoroethane in concentrations not in excess of 500 parts per million (ppm) (4,170 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-tetrachloro-1,2-difluoroethane.

(b) Exposure determination and measurement.

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

(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-tetrachloro-1,2-difluoroethane;

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

(iii) Any employee complaints of symptoms which may be attributable to exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane; 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane 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.

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

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to 1,1,2,2-tetrachloro-1,2-difluoroethane 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
Above permissible exposure	$\pm 25\%$
At or below permissible exposure and above the action level	$\pm 35\%$
At or below the action level	$\pm 50\%$

(d) Compliance. (1) No employee shall be exposed to 1,1,2,2-tetrachloro-1,2-difluoroethane above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of 1,1,2,2-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving 1,1,2,2-tetrachloro-1,2-difluoroethane shall be classified as C-1 at 79 degrees F.

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

(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-tetrachloro-1,2-difluoroethane 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 1,1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
5000 ppm or less	Any supplied air respirator.
	Any self-contained breathing apparatus.
15,000 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood.
	Any self-contained breathing apparatus with a full facepiece.
	A Type C supplied-air respirator with a half-mask operated in pressure-demand or other positive pressure mode.
	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Greater than 15,000 ppm or entry and escape from unknown concentrations	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.
	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive

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

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-tetrachloro-1,2-difluoroethane.

(2) 1,1,2,2-Tetrachloro-1,2-difluoroethane 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 repeated or prolonged skin contact with liquid or solid 1,1,2,2-tetrachloro-1,2-difluoroethane. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that non-impervious clothing which becomes wet with liquid 1,1,2,2-tetrachloro-1,2-difluoroethane or contaminated with solid 1,1,2,2-tetrachloro-1,2-difluoroethane be removed promptly and not reworn until the 1,1,2,2-tetrachloro-1,2-difluoroethane is removed from the clothing.

(3) Employers shall provide and ensure that employees use safety goggles (cup-cover type dust and splash safety goggles) which comply with § 1910.133 (a)(2)-(a)(6) where liquid or solid 1,1,2,2-tetrachloro-1,2-difluoroethane may contact the eyes.

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

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

(i) Training and information. (1) Each employer who has a workplace in which 1,1,2,2-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane above the action level or employees who may have skin or eye contact with 1,1,2,2-tetrachloro-1,2-difluoroethane, or employees who work where an accidental spill of 1,1,2,2-tetrachloro-1,2-difluoroethane may occur, shall annually:

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

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

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

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

(iv) Instruct affected employees to inform the employer if they develop any of the medical conditions listed in paragraph (j)(2) of this section; and

(v) 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-tetrachloro-1,2-difluoroethane.

(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 obtain from each employee who is exposed, or will be exposed, to liquid 1,1,2,2-tetrachloro-1,2-difluoroethane airborne concentrations of 1,1,2,2-tetrachloro-1,2-difluoroethane at or above the action level, without regard to the use of respirators, information as to whether such employee has a history of chronic lung disease.

(3) The employer shall provide a medical examination for the employee if:

(i) The employee provides a history of any of the medical conditions listed in paragraph (j)(2) of this section; or

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane which are listed in Appendix A which the employee suspects are caused by exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane.

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

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

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

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

(iv) The results of any measurements 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 examinations of the affected employee.

(5) Where a medical examination is required by paragraph (j)(3) of this section, following such examination the employer shall obtain a written opinion from the examining physician which conforms with paragraph (j)(6) of this section.

(6)(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 condition which would place the employee at increased risk of material impairment of the employee's health from exposure to 1,1,2,2-

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

tetrachloro-1,2 -difluoroethane or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane 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 diagnoses unrelated to exposure to 1,1,2,2 -tetrachloro-1,2-difluoroethane.

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

(7) No employee shall be exposed to liquid 1,1,2,2-tetrachloro -1,2-difluoroethane or airborne concentrations of 1,1,2,2 -tetrachloro-1,2-difluoroethane 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.

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

(9) 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 risk involved by refusal to be examined.

(10) 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-tetrachloro-1,2-difluoroethane.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane 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.

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

(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.

(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) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;

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

(C) A copy of information provided to the physician pursuant to paragraph (j)(4)(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-tetrachloro-1,2-difluoroethane which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to 1,1,2,2-tetrachloro-1,2-difluoroethane 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.

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

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

(iii) Record the results obtained.

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.

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

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR 1,1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE

- I. SUBSTANCE IDENTIFICATION
- A. Substance: 1,1,2,2-Tetrachloro-1,2-difluoroethane
 - B. Permissible Exposure: 500 parts of 1,1,2,2-tetrachloro-1,2-difluoroethane per million parts of air (ppm) or 4170 milligrams of 1,1,2,2-tetrachloro-1,2-difluoroethane per cubic meter of air (mg/m³) averaged over an eight-hour work shift.
 - C. Appearance and Odor: Colorless liquid or solid with a slight ether-like odor.
- II. HEALTH HAZARD DATA
- A. Ways in Which the Chemical Affects Your Body: 1,1,2,2-Tetrachloro-1,2-difluoroethane can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also affect your body if you swallow it.
 - 1. Short-Term Exposure: 1,1,2,2-tetrachloro-1,2-difluoroethane might cause irritation of the skin and eyes. It might also cause drowsiness and difficult breathing.
 - 2. Long-Term Exposure: None known.
 - 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-tetrachloro-1,2-difluoroethane.
- III. EMERGENCY FIRST AID PROCEDURES
- A. Eye Exposure: If 1,1,2,2-tetrachloro-1,2-difluoroethane gets into your eyes, wash your eyes immediately with large amounts of water, 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-tetrachloro-1,2-difluoroethane gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,1,2,2-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane, 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-tetrachloro-1,2-difluoroethane has been swallowed get medical attention immediately. If medical

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

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-tetrachloro-1,2-difluoroethane. 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-tetrachloro-1,2-difluoroethane 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 or solid 1,1,2,2-tetrachloro-1,2-difluoroethane. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid or solid 1,1,2,2-tetrachloro-1,2-difluoroethane may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. 1,1,2,2-Tetrachloro-1,2-difluoroethane must be stored in tightly closed containers in a well ventilated area away from chemically active metals, such as sodium, potassium, and beryllium, and from powdered magnesium, aluminum and zinc.
- B. If your skin becomes wet with liquid 1,1,2,2-tetrachloro-1,2-difluoroethane or contaminated with solid 1,1,2,2-tetrachloro-1,2-difluoroethane, you must promptly wash or shower using soap or mild detergent and water to remove the 1,1,2,2-tetrachloro-1,2-difluoroethane from your skin.
- C. You must promptly remove any non-impervious clothing that becomes wet with liquid 1,1,2,2-tetrachloro-1,2-difluoroethane or contaminated with solid 1,1,2,2-tetrachloro-1,2-difluoroethane and this clothing must not be

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

reworn until the 1,1,2,2-tetrachloro-1,2-difluoroethane is removed from the clothing.

- D. Ask your supervisor where 1,1,2,2-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane. In addition, your employer must instruct you in the safe use of 1,1,2,2-tetrachloro-1,2-difluoroethane, 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-tetrachloro-1,2-difluoroethane. 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.

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

APPENDIX B

SUBSTANCE TECHNICAL DATA
FOR 1,1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: Refrigerant 112; halocarbon 112
 2. Formula: CCl2F-CCl2F
 3. Molecular weight: 203.8
- B. Physical Data
1. Boiling point (760 mm Hg): 92.8 C (199 F)
 2. Specific gravity (Water = 1): 1.65
 3. Vapor density (air = 1 at boiling point of 1,1,2,2-tetrachloro-1,2-difluoroethane): 7
 4. Melting point: 26 C (79 F)
 5. Vapor pressure at 20 C (68 F): 40 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): 0.012
 7. Evaporation rate (butyl acetate = 1): greater than 1
 8. Appearance and odor: Colorless liquid or solid with a slight ether-like odor.
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Not combustible
- B. Reactivity
1. Conditions contributing to instability: Heat
 2. Incompatibilities: Reacts with chemically active metals such as sodium, potassium and beryllium, or with powdered aluminum, zinc and magnesium.
 3. Hazardous decomposition products: Toxic gases and vapor (such as hydrogen chloride, hydrogen fluoride, and carbon monoxide) may be released when 1,1,2,2-tetrachloro-1,2-difluoroethane decomposes.
 4. Special precautions: 1,1,2,2-Tetrachloro-1,2-difluoroethane will attack some forms of plastics, rubber and coatings.
- III. SPILL, LEAK, AND DISPOSAL PROCEDURES
- A. If 1,1,2,2-tetrachloro-1,2-difluoroethane is spilled or leaked, the following steps should be taken:
1. Ventilate area of spill or leak.
 2. If in the liquid form, collect for reclamation or absorb in vermiculite, dry sand, earth or a similar material.
 3. If in the solid form, collect spilled material in the most convenient and safe manner for reclamation or for disposal in a secured sanitary landfill.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.

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

- C. Waste disposal methods: 1,1,2,2-Tetrachloro-1,2-difluoroethane may be disposed of:
1. If in the liquid form, by absorbing in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.
 2. If in the solid form, 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane in tightly closed containers in a well ventilated area.
- B. High exposures to 1,1,2,2-tetrachloro-1,2-difluoroethane 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-tetrachloro-1,2-difluoroethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,1,2,2-tetrachloro-1,1-difluoroethane is likely to occur are: during its use as a solvent and cleaning agent; as a blowing agent or foaming agent in the

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

polymer and plastics industry; as a dye solvent; and during its production.

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

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

1,1,2,2-Tetrachloro-1,2-difluoroethane vapor is a narcotic. Rats exposed to 10,000 ppm for 1 1/2 to 2 hours showed signs of intoxication; concentrations of 20,000 to 30,000 ppm for the same period were fatal and caused pulmonary hemorrhages. In rats repeatedly exposed for 6 hours to 1,000 ppm, there were no clinical signs of toxicity; some showed slight changes in liver cells, and a few female rats had a decreased leukocyte count. The liquid applied to the intact skin of guinea pigs produced mild irritation in 24 hours. Instilled in the eyes of rabbits, it produced mild conjunctival irritation.

III. SIGNS AND SYMPTOMS

Possible skin irritation; conjunctival irritation; at high levels may produce pulmonary edema.

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. Treat heavy inhalation exposures in anticipation of possible pulmonary edema. Recovery is usually complete.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

In animals at high concentrations, 1,1,2,2-tetrachloro -1,2-difluoroethane causes central nervous system depression and lung damage. It is important that the physician becomes familiar with plant operating conditions in which exposure to 1,1,2,2-tetrachloro-1,2 -difluoroethane occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain

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

medical conditions (listed below) which might place the employee at increased risk from 1,1,2,2-tetrachloro-1,2-difluoroethane exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,1,2,2-tetrachloro-1,2-difluoroethane 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: "1,1,2,2-Tetrachloro-1,2-Difluoroethane," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 249.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1130-1131.
3. Clayton, J. W., et al: "Toxicity Studies on 1,1,2,2-Tetrachloro-1,2-Difluoroethane and 1,1,1,2-Tetrachloro-2,2-Difluoroethane," American Industrial Hygiene Association Journal, 27:332-340, 1960.

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

REFERENCES AND SOURCES
1,1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE
1910.93

- (d) Compliance - Open surface tank classification based on relative evaporation rate estimated as "fast" based on boiling point and guidelines in ANSI Z9.1.
- (f) Personal Protective Equipment, and (h) Sanitation
- Eye: J. W. Clayton et al., "Toxicity studies on 1,1,2,2-Tetrachloro-1,2-difluoroethane and 1,1,1,2-Tetrachloro-2,2-difluoroethane;" American Industrial Hygiene Association Journal, 27:332, 1966
- Skin: J. W. Clayton et al., "Toxicity studies on 1,1,2,2-Tetrachloro-1,2-difluoroethane and 1,1,1,2-Tetrachloro-2,2-difluoroethane;" American Industrial Hygiene Association Journal, 27:332, 1966; Sax, "Dangerous Properties of Industrial Materials"
- Ingestion: J. W. Clayton et al., "Toxicity Studies on 1,1,2,2-Tetrachloro-1,2-difluoroethane and 1,1,1,2-Tetrachloro-2,2-difluoroethane;" American Industrial Hygiene Association Journal, 27:332, 1966; Patty, "Industrial Hygiene and Toxicology;" American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values"

COMMENTS

Eye - Classification: 2 and 6

Output statement numbers: 10, 12

Exceptions: 10 and 12 combined into one statement

Clayton et al showed that application of .1 ml undiluted TCDF "produced only mild conjunctival irritation" which lasted for 24 - 48 hours depending upon test procedures; they found no detectable changes in the cornea or iris from this application. Because the substance has a melting point of about 79 F, it is treated as both a solid and a liquid which does not produce serious eye effects.

Skin - Classification: 2 and 6

Output statement numbers: 2, 16g and 17g, 16i and 17i

Exceptions: 16 and 17 combined into one statement; 5b, 7 and 20 deleted

Work by Clayton et al showed application of 7500 mg/kg to the skin of rabbits produced "transient erythema at the application site, but no systemic effects." Several histological changes were noted, "but it was not possible to establish clearly that these were a result of dosing." In other work by Clayton et al, the substance "when applied undiluted and uncovered to the intact and abraded skin of guinea pigs, produced mild irritation in 24 hours; it did not produce sensitization." Sax states that it is not toxic in acute local exposures. The substance is not combustible. Its vapor pressure at 20 C is 40 mm Hg. The effects of the substance were not felt serious enough to warrant the use of statements 5b or 7. The vapor pressure of the substance was concluded to be high enough

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

that statement 20 is not required.
Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Clayton and co-workers found that the approximate lethal dose (ALD) was greater than 25 g/kg body weight in rats although some effects, including weight loss and hyperactivity were noted at lower doses; "there was no clinical effect at 670 mg/kg." Five male rats dosed at 5 g/kg for 10 days showed "an initial weight loss, inactivity and forelimb tremor; increased activity was observed in the second week." Although rats sacrificed shortly after the exposure ended showed histologic changes in the liver and kidney, "rats sacrificed 13 days after the treatment ended showed no significant changes in liver and kidney." Patty and Documentation of TLV's state that this compound was administered to rats in doses of 2 g/kg of body weight per day for 23 to 33 days without any apparent observable effect or pathological change. Patty continues "the materials were probably not readily absorbed from the gastrointestinal tract, as most of the material was recovered from the gastrointestinal tract or the feces." It is concluded that the substance does not present a hazard by ingestion in the work place.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

E. I. duPont de Nemours and Co., "Freon 112" and "Freon Compounds and Safety" (duPont)

Union Carbide Corp., "Chemicals and Plastics, Physical Properties," 1973 - 1974 (UCC)

D. R. Stull, Ind. Eng. Chem., 39, p. 517 (1947) (Stull)

Sources of data items used:

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

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

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

"Chemical Abstracts," American Chemical Society, Vol. 62 - 79, 1965 - 1973 (CA)

Clayton, J. W., Sherman, H., Morrison, S. D., Barnes, J. R., and Hood, D. B., American Industrial Hygiene Association Journal, 27 #4:322 - 340 (1966) (Clayton)

"Freon Product Information," B-2, E. I. duPont de Nemours and Company, 1969 (duPont)

Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," 2nd edition, Interscience Publishers, 1972 (K-O)

References for Specific Use/Exposure

1. CA, K-O
2. CA
3. CA
4. Clayton, CA
5. K-O
6. CA
7. CA
8. ADL estimate, duPont

References for Specific Control Methods

DuPont was the reference used in the Specific Control Methods for numbers 1 - 4.

5. ADL estimate, duPont

DuPont was the reference used in the Specific Control Methods for number 6 - 8.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 500 ppm.

WARNING PROPERTIES: No quantitative data are available relating warning properties of 1,1,2,2-tetrachloro-1,2-difluoroethane to its air concentrations. Therefore, 1,1,2,2-tetrachloro-1,2-difluoroethane is treated as a material with poor warning properties, and gas sorbent respiratory equipment is not permitted.

EYE IRRITATION: Deichmann and Gerarde report that 1,1,2,2-tetrachloro-1,2-difluoroethane is mildly irritating to rabbit eyes, but the levels at which irritation occurs are not given. For the purposes of this standard, therefore, 1,1,2,2-tetrachloro-1,2-difluoroethane is treated as if it produces effects which are irritating to the eyes, even at low concentrations.

LFL: 1,1,2,2-Tetrachloro-1,2-difluoroethane is not flammable.

IDLH: 15,000 ppm.

IDLH BASIS: Based upon the report in the Documentation of TLV's that a 1 1/2- to 2-hour exposure to 10,000 ppm produced slight intoxication in rats, and upon the report that a 4-hour exposure to 15,000 ppm was fatal to rats, for the purposes of this standard, an IDLH concentration of 15,000 ppm 1,1,2,2-tetrachloro-1,2-difluoroethane is assumed.

SUMMARY OF TOXICOLOGY:

- According to the Documentation of TLV's, rats exposed to 10,000 ppm 1,1,2,2-tetrachloro-1,2-difluoroethane for 1 1/2 - 2 hours became slightly intoxicated, but did not lose their reflexes. Death and severe pulmonary hemorrhages resulted from 1- to 2 1/2-hour exposures to concentrations of 20,000 to 30,000 ppm. Eighteen-hour daily exposures to 1000 ppm for 16 days caused no observable pathologic changes in the liver, lungs or

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

spleen, but 5000 ppm over the same exposure period caused "loss of consciousness and death." The lungs of the animals exposed to 5000 ppm were "swollen and hemorrhagic."

The Documentation of TLV's notes that one investigator found 15,000 ppm to be fatal to rats after a 4-hour exposure. The rats survived 31 6-hour exposures to 1000 ppm 1,1,2,2-tetrachloro-1,2-difluoroethane, but "some leukopenia and liver changes were noted."

VAPOR PRESSURE AT 20 C: 40 mm.

SATURATED AIR CONCENTRATION: 52,600 ppm.

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

USE/EXPOSURE AND CONTROL DOCUMENTS
1,1,1,2,2-TETRACHLORO-1,2-DIFLUOROETHANE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use in the dry cleaning industry for wool, cotton, dacron and leather materials (mostly as the main ingredient of an azeotropic mixture with other solvents to lower its freezing point but also the heated chemical by itself)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves)
2.	Inhalation of vapor and skin contact with liquid during use in the electronic or electric industry (azeotropic mixture used for cleaning rosin flux from printed circuit boards, cleaning solvent for complex electronic parts and magnetic tapes)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves)
3.	Inhalation of vapor during use in the polymer and plastics industry (blowing agent or foaming agent for cellular and microporous materials, spinning solution for opaque acrylic fibers)	A	Local exhaust ventilation
4.	Inhalation of vapor and skin contact with liquid during biological applications (solvent extractant in the separation and purification of viruses, anthelmintic to sheep and cattle)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves)
5.	Inhalation of vapor during manufacture of 1,1,2,2-tetrachloro-1,2-difluoroethane (hydrogen fluoride is added to tetrachloroethylene and chlorine in the presence	A	Process enclosure; local exhaust ventilation; general dilution ventilation

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

of a catalyst. The product is purified by distillation, scrubbing and drying)

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|----|--|-----|---|
| 6. | Inhalation of vapor and skin contact with liquid during use as a dye solvent (to give brighter colors in less time, to detect surface cracks or defects in metals) | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, protective clothing) |
| 7. | Inhalation of vapor during miscellaneous applications (corrosion inhibitor - added to brake fluid, surface coating with silicone on electrical equipment; heat control of reactions - cools reactions by its heat of evaporation, propellant - used in propellant mixtures for perfumes) | A | Local exhaust ventilation; general dilution ventilation |
| 8. | Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage vessels and during cleanup of accidental spills | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, respiratory protective devices, protective clothing, goggles) |

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

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

1,181 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

