

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE ***

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

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-TRICHLORO-1,2,2-TRIFLUOROETHANE.

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-TRICHLORO-1,2,2-TRIFLUOROETHANE

(a) Definitions.

(1) "Permissible exposure" means inhalation of 1,1,2-trichloro-1,2,2-trifluoroethane in concentrations not in excess of 1,000 parts per million (ppm) (7,600 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-trichloro-1,2,2-trifluoroethane.

(b) Exposure determination and measurement.

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

(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-trichloro-1,2,2-trifluoroethane;

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

(iii) Any employee complaints of symptoms which may be attributable to exposure to 1,1,2-trichloro-1,2,2-trifluoroethane; 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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane 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-TRICHLORO-1,2,2-TRIFLUOROETHANE

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane.

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

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

(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-trichloro-1,2,2-trifluoroethane to at or below the permissible exposure; or

(iv) 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-TRICHLORO-1,2,2-TRIFLUOROETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
4500 ppm or less	Any supplied-air respirator.
	Any self-contained breathing apparatus.
Greater than 4500 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-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.

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

(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-trichloro-1,2,2-trifluoroethane.

(2) 1,1,2-Trichloro-1,2,2-trifluoroethane 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 1,1,2-trichloro-1,2,2-trifluoroethane. 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-trichloro-1,2,2-trifluoroethane be removed promptly and not reworn until the 1,1,2-trichloro-1,2,2-trifluoroethane is removed from the clothing.

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

(g) Spills and disposal. In the event that liquid 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane promptly wash or shower with soap or mild detergent and water to remove any 1,1,2-trichloro-1,2,2-trifluoroethane from the skin.

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

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane.

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

(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-trichloro-1,2,2-trifluoroethane or airborne concentrations of 1,1,2-trichloro-1,2,2-trifluoroethane at or above the action level, without regard to the use of respirators, information as to whether such employee has a history of any of the following medical conditions:

- (i) Skin disease
- (ii) Heart 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-trichloro-1,2,2-trifluoroethane which are listed in Appendix A which the employee suspects are caused by exposure to 1,1,2-trichloro-1,2,2-trifluoroethane.

(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-trichloro-1,2,2-trifluoroethane;

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

(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-trichloro-1,2,2-trifluoroethane or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane.

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

(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-trichloro-1,2,2-trifluoroethane or airborne concentrations of 1,1,2-trichloro-1,2,2-trifluoroethane 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 examination treatment for any employee injured through exposure to 1,1,2-trichloro-1,2,2-trifluoroethane.

(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-trichloro-1,2,2-trifluoroethane.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,1,2-trichloro-1,2,2-trifluoroethane 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.

(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:

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

- (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-trichloro-1,2,2-trifluoroethane;
 - (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-trichloro-1,2,2-trifluoroethane which is conducted pursuant to this section.
 - (2) When observation of measurement of employee exposure to 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane that are being performed at the place of exposure; and
 - (iii) Record the results obtained.

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

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-TRICHLORO-1,2,2-TRIFLUOROETHANE

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR 1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

- I. SUBSTANCE IDENTIFICATION
- A. Substance: 1,1,2-Trichloro-1,2,2-trifluoroethane
 - B. Permissible Exposure: 1000 parts of 1,1,2-trichloro-1,2,2-trifluoroethane per million parts of air (ppm) or 7600 milligrams of 1,1,2-trichloro-1,2,2-trifluoroethane per cubic meter of air (mg/m³) averaged over an eight-hour work shift.
 - C. Appearance and Odor: Colorless liquid with an odor like carbon tetrachloride at high concentrations.
- II. HEALTH HAZARD DATA
- A. Ways in Which the Chemical Affects Your Body: 1,1,2-Trichloro-1,2,2-trifluoroethane 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.
 - B. Effects of Overexposure:
 - 1. Short-Term Exposure: 1,1,2-trichloro-1,2,2-trifluoroethane may cause irritation of the eyes and throat or drowsiness. Breathing high concentrations may cause your heart to beat irregularly or to stop.
 - 2. Long-Term Exposure: 1,1,2-trichloro-1,2,2-trifluoroethane on prolonged or repeated contact with the skin may 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-trichloro-1,2,2-trifluoroethane.
- III. EMERGENCY FIRST AID PROCEDURES
- A. Eye Exposure: If 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane, 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.

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

- D. Swallowing: When 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane. You can only be required to wear them for routine use if your employer is in the process of installing controls or other control measures prove inadequate. You may be required to wear respirators for non-routine activities or in emergencies. If respirators are worn, they must have a Mining Enforcement and Safety Administration (MESA) 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-trichloro-1,2,2-trifluoroethane 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 1,1,2-trichloro-1,2,2-trifluoroethane. 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) where eye contact to liquid 1,1,2-trichloro-1,2,2-trifluoroethane may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. 1,1,2-Trichloro-1,2,2-trifluoroethane must be stored in tightly closed containers in a well ventilated area away from chemically active metals such as calcium and powdered aluminum, zinc, magnesium and away from beryllium and from magnesium alloys.
- B. If your skin becomes wet with liquid 1,1,2-trichloro-1,2,2-trifluoroethane, you must promptly wash or shower to remove the 1,1,2-trichloro-1,2,2-trifluoroethane from your skin.
- C. You must promptly remove any non-impervious clothing that becomes wet with liquid 1,1,2-trichloro-1,2,2-trifluoroethane

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

and this clothing must not be reworn until the 1,1,2-trichloro-1,2,2-trifluoroethane is removed from the clothing.

- D. 1,1,2-trichloro-1,2,2-trifluoroethane vapors may accumulate in low places and result in suffocating atmospheres.
- E. Ask your supervisor where 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane. In addition, your employer must instruct you in the safe use of 1,1,2-trichloro-1,2,2-trifluoroethane, 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-trichloro-1,2,2-trifluoroethane. 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-TRICHLORO-1,2,2-TRIFLUOROETHANE

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES FOR
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: Halocarbon 113; refrigerant 113; TTE
 2. CCl₂F-CClF₂
 3. Molecular weight: 187.4
- B. Physical Data
1. Boiling point (760 mm Hg): 47.6 C (117.6 F)
 2. Specific gravity (Water = 1): 1.55
 3. Vapor density (air = 1 at boiling point of 1,1,2-trichloro-1,2,2-trifluoroethane): 6.5
 4. Melting point: -35 C (-31 F)
 5. Vapor pressure at 20 C (68 F): 284 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): 0.017
 7. Evaporation rate (butyl acetate = 1): greater than 1
 8. Appearance and odor: Colorless liquid with an odor like carbon tetrachloride (at high concentrations)
- 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 calcium, powdered aluminum, zinc, magnesium, and beryllium. Contact with magnesium alloys containing more than 2% magnesium may cause decomposition.
 3. Hazardous decomposition products: Toxic gases and vapor (such as hydrogen chloride, hydrogen fluoride, phosgene, and carbon monoxide) may be released when 1,1,2-trichloro-1,2,2-trifluoroethane decomposes.
 4. Special precautions: 1,1,2-Trichloro-1,2,2-trifluoroethane will attack some forms of plastics, rubber and coatings.
- III. SPILL, LEAK, AND DISPOSAL PROCEDURES
- A. If 1,1,2-trichloro-1,2,2-trifluoroethane 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 complete
- C. Waste disposal methods: 1,1,2-Trichloro-1,2,2-trifluoroethane may be disposed of by absorbing in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

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

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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane in tightly closed containers in a well ventilated area.
- B. High exposures to 1,1,2-trichloro-1,2,2-trifluoroethane 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-trichloro-1,2,2-trifluoroethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,1,2-trichloro-1,2,2-trifluoroethane is likely to occur are: during its use as refrigerating fluid; as a heat transfer medium; as a selective solvent for oils and greases; as a chemical intermediate in the production of chlorotrifluoroethylene; as a solvent in the textile and dry cleaning industry; as a blowing and foaming agent in the production of polymers; and during its production.

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

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

1,1,2-Trichloro-1,2,2-trifluoroethane vapor is a narcotic. In guinea pigs exposed to 25,000 ppm, nasal irritation was rapidly apparent and incoordination occurred at 50,000 ppm after 30 minutes; deaths occurred after one hour at this level. In dogs, cardiac sensitization to epinephrine occurred at concentrations of 5,000 to 10,000 ppm. The liquid produced no irritation on the abraded or intact skin of guinea pigs; in the eyes of rabbits it produced mild conjunctivitis and minimal corneal dullness which were reversible. In experimental human studies, exposure to 4,500 ppm for 30 to 100 minutes resulted in significant impairment in tests of manual dexterity and vigilance; subjects reported loss of concentration and a tendency to somnolence which disappeared 15 minutes after the exposure ended; at 1,500 ppm no effects were observed. More prolonged human exposures of 6 hours daily, 5 days per week for 2 weeks at concentrations of approximately 500 and 1,000 ppm resulted in no adverse effects with the exception of mild throat irritation on the first day; there was no decrement in performance of complex mental tasks. The liquid dissolves the natural oils of the skin and dermatitis may occur as a result of repeated contact.

III. SIGNS AND SYMPTOMS

Mild throat irritation; drowsiness; repeated skin contact with the liquid may cause dermatitis. Cardiac arrhythmias have been produced in animals.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Flush eyes and skin with water. If swallowed and the person is conscious, induce vomiting. Give artificial resuscitation if indicated. Particular attention should be directed to the detection of cardiac arrhythmias. The use of vasopressor drugs like epinephrine is contraindicated and may be dangerous. Recovery is usually rapid and complete.

-VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

1,1,2-Trichloro-1,2,2-trifluoroethane at high concentrations is a central nervous system depressant and may sensitize the myocardium.

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

It is important that the physician becomes familiar with plant operating conditions in which exposure to 1,1,2-trichloro-1,2,2-trifluoroethane occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

Routine medical histories and physical examination are not required. However, the employer must screen employees for history of certain medical conditions (listed below) which might place the employee at increased risk from 1,1,2-trichloro-1,2,2-trifluoroethane exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- 1,1,2-Trichloro-1,2,2-trifluoroethane is a defatting agent and can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Cardiovascular disease -- In persons with impaired cardiovascular function, especially those with history of cardiac arrhythmias, the breathing of 1,1,2-trichloro-1,2,2-trifluoroethane might cause exacerbation of symptoms due to its sensitizing 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-Trichloro-1,2,2-Trifluoroethane," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 267-268.
2. Hygienic Guide Series: "1,1,2-Trichloro-1,2,2-Trifluoroethane," American Industrial Hygiene Association Journal, 29:521-525, 1968.
3. Stopps, G. J. and M. McLaughlin: "Psychophysiological Testing of Human Subjects Exposed to Solvent Vapors," American Industrial Hygiene Association Journal, 28:43-50, 1967.
4. Reinhardt, C. F. et al: "Cardiac Sensitization Potential of Some Common Industrial Solvents," Industrial Hygiene News Report, 15:3-4, 1972.

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

REFERENCES AND SOURCES
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE
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: Grant, "Toxicology of the Eye;" E. I. duPont de Nemours and Co., "Freon Compounds and Safety"
- Skin: American Industrial Hygiene Association, Hygienic Guide, "1,1,2-Trichloro-1,2,2-Trifluoroethane;" E. I. duPont de Nemours and Co., "Freon Compounds and Safety"
- Ingestion: American Industrial Hygiene Association, Hygienic Guide, "1,1,2-Trichloro-1,2,2-Trifluoroethane"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Grant states that it "appears to be only superficially injurious to the eye; testing by applying 0.1 ml to rabbit eyes is reported to have produced only mild conjunctivitis and minimal corneal dullness at 24 hours with complete recovery in another 24 hours. Information from E. I. duPont de Nemours and Co. attributes "temporary redness" to eye contact with this substance.

Skin - Classification: 2

Output statement numbers: 2, 16g, 16i

Exceptions: 7 and 20 deleted

According to the Hygienic Guide, the substance "dissolves the natural oils of the skin and dermatitis may occur as a result of repeated contact." Information from duPont de Nemours supports this finding. The Hygienic Guide continues, "applications to the skin of rabbits indicated an approximate lethal dosage of greater than 11 gm/kg while 5 gm/kg per day applied for 5 days caused fluctuation in weight and damage to the skin. Slight liver changes were also noted, but no other systemic effects were seen."

The substance is not combustible. Its vapor pressure at 20 C is 284 mm Hg. The effects of the substance coupled with its high vapor pressure led to the conclusion that statements 7 and 20 are not necessary.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

A rat LD50 of 43 gm/kg body weight is reported in the Hygienic Guide. A comparable human exposure in an industrial setting is unlikely given the high vapor pressure of the material.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

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

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

"Matheson Gas Data Book," 5th edition, 1971, p. 547 (Math)
Union Carbide Corp., "Chemicals and Plastics, Physical Properties,"
1973 - 1974 and "Linde Specialty Gases" (UCC)

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

Sources of data items used:

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

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- "Chemical Abstracts," American Chemical Society, Volumes 66 - 77,
1966 - 1972 (CA)
- "Freon," Product Information B-2, E. I. duPont de Nemours and Company,
1969 (duPont)
- "Isotron Refrigerants," Product Information on Isotron Refrigerants,
Pennwalt Corp. (Isotron)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Inter-
science Publishers, Second Edition, 1972 (K-O)
- Mellan, I., "Source Book of Industrial Solvents," Vol. II, Reinhold
Publishing Corp., 1957 (Mellan)
- "Modern Plastics Encyclopedia," Vol. 51, No. 10A, McGraw-Hill, October
1974 (MPE)
- Stanford Research Institute, "Chemical Economics Handbook," Menlo Park,
California (SRI)
- "1,1,2-Trichloro-1,2,2-trifluoroethane," Hazards Process Index, Hazard Entry
#85a, NIOSH, HSM-99-73-62 (HPI)
- "1,1,2-Trichloro-1,2,2-trifluoroethane," Hygienic Guide Series, American
Conference of Government Industrial Hygienists, Sept. - Oct. 1968
(Hygienic Guide)

References for Specific Use/Exposure

- 1. CA, K-O, SRI
- 2. duPont, Isotron, SRI
- 3. CA, K-O, SRI
- 4. CA, SRI
- 5. HPI
- 6. CA, MPE
- 7. CA

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

8. ADL estimate, Hygienic Guide
 9. Hygienic Guide, Mellan
- References for Specific Control Methods

Hygienic Guide was the reference used in numbers 1 - 9.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 1000 ppm.

WARNING PROPERTIES: Since the AIHA Hygienic Guides state that TCTFE is "nearly odorless," and since experimental evidence indicates that the irritant effects of TCTFE are only slight and transient at concentrations near the permissible exposure, TCTFE is treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted.

EYE IRRITATION: There is no evidence to indicate that TCTFE vapor is an eye irritant. The Documentation of TLV's states that "no corneal injury or irritation" was observed in guinea pigs exposed to TCTFE. For the purposes of this standard, therefore, TCTFE is not treated as an eye irritant.

LFL: TCTFE is not flammable.

IDLH: 4500 ppm.

IDLH BASIS: Based upon the statements in the AIHA Hygienic Guides and in the Documentation of TLV's that a 2 3/4 hour-exposure to a concentration of 4500 ppm TCTFE significantly impaired the psychomotor performance of human volunteers, an IDLH concentration of 4500 ppm is assumed for the purposes of this standard.

SUMMARY OF TOXICOLOGY:

Exposures to 1,1,2-trichloro-1,2,2-trifluoroethane (TCTFE) can result in depression of the central nervous system and in irritation of the respiratory tract. The AIHA Hygienic Guides report that there were no observable effects in human male volunteers exposed to 1500 ppm TCTFE for 2 3/4 hours. A "slight effect on the psychophysiological functions" was evident at 2500 ppm, with "progressive deterioration of these functions as the concentration was increased to 4500 ppm." According to the Hygienic Guides, exposures of these men to 2500 ppm for 1/2 to 1 hour produced such subjective symptoms as drowsiness, "loss of concentration, 'heaviness' in the head, and slight loss of correspondence between visual and labyrinth sensations of head rotation." Objective effects on the psychophysiological functions were evident after a 2 3/4-hour exposure to 2500 ppm TCTFE. Exposure of the men to the concentration of 4500 ppm for 2 3/4 hours significantly impaired their psychomotor performance.

The Documentation of TLV's states that repeated human exposures of 500 to 1000 ppm for 6 hours daily, 5 days per week for 2 weeks, produced no adverse effects other than slight irritation of the throat on the first day.

The Hygienic Guides report that a 2-hour exposure to 11,000 ppm TCTFE produced mild narcotic effects in guinea pigs. No "biochemical or histologic signs of toxicity" were observed in cats and dogs exposed to 12,500 ppm for 3 1/2 hours per day for 20 days, or in guinea pigs and rats exposed to 25,000 ppm TCTFE for the same exposure periods. Death occurred in rats exposed to 37,000 ppm for 4 hours.

The Documentation of TLV's reports that guinea pigs experienced nasal irritation at an exposure concentration of 25,000 ppm for 5 minutes, "loss of coordination at 50,000 ppm after 30 minutes," and death at 50,000 ppm

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

after 1 hour.

VAPOR PRESSURE AT 20 C: 284 mm.

SATURATED AIR CONCENTRATION: 373,700 ppm.

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

USE/EXPOSURE AND CONTROL DOCUMENT
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE

Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor and skin contact with liquid during use as a selective solvent (dissolves oils and greases from electric equipment, photographic films, magnetic tapes, precision instruments, plastics, glass and fibers, resin solder fluxes from printed circuit boards - without affecting plastics, elastomers or metal components)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
2. Inhalation of vapor during use as a refrigerant (commercial and industrial air conditioning, industrial process cooling) It is especially useful in small tonnage applications	A	General dilution ventilation
3. Inhalation of vapor during use as a chemical intermediate (dechlorinization to produce chlorotrifluoroethylene which is used to manufacture many commercially valuable polymers, copolymer in the production of high temperature lubricants)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
4. Inhalation of vapor and skin contact with liquid during use as a dry cleaning solvent especially effective for furs, suedes, leather and bonded fabrics but excellent for all fabrics)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves)
5. Inhalation of vapor during the production of 1,1,2-trichloro-1,2,2-trifluoroethane (hexachloroethane reacts	A	Process enclosure; local exhaust ventilation; general dilution ventilation

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

with liquid hydrogen fluoride in the presence of a catalyst to form trichlorotrifluoroethane. The product is purified by fractional distillation)

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|----|---|-----|--|
| 6. | Inhalation of vapor during use as a foaming or blowing agent in the manufacture of polymers (flame retardant cellular polymers) | A | Process enclosure; local exhaust ventilation; general dilution ventilation |
| 7. | Inhalation of vapor and skin contact with liquid during use in the textile industry (solvent for dyes, component of solutions applied to textiles to render them oil and water repellant) | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves) |
| 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 (respiratory protective devices, gloves, goggles) |
| 9. | Inhalation of vapor and skin contact with liquid during special laboratory usage (solvent for molecular weight determinations, component of low temperature baths) | A,B | Local exhaust ventilation; general dilution ventilation; personal protective equipment (polyvinyl gloves) |

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

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

1,163 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

