NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND SUPPORTING DOCUMENTATION FOR

*** 1,1,2-TRICHLOROETHANE ***

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

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-TRICHLOROETHANE.

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-TRICHLOROETHANE

(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of 1,1,2-trichloroethane not in excess of 10 parts per million (ppm) (15 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-trichloroethane.

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

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

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

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

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

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to 1,1,2-trichloroethane

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 percent, of not less than that given in Table 1.

Table 1

Concentration	Required Accuracy
Above permissible exposure	± 25%
At or below permissible exposure and above the action level	± 35%
At or below the action level	± 50%

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

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

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

(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-trichloroethane 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-TRICHLOROETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
500 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 500 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.

(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-trichloroethane.

(2) For the purpose of compliance with § 1910.309, locations classified as hazardous locations due to the presence of 1,1,2-trichloroethane shall be Class I, Group D.

(3) For the purpose of compliance with § 1910.157, 1,1,2-trichloroethane is classified as a Class B fire hazard.

(4) For the purpose of compliance with § 1910.178, locations classified as hazardous locations due to the presence of 1,1,2-trichloroethane shall be Class I, Group D.

(5) Where a fan is located in ductwork and where 1,1,2-trichloroethane is present in the ductwork in concentrations greater than 15,000 ppm (approximately 25 percent of the lower flammable limit), the fan rotating element shall be of nonsparking material or the casing shall consist of, or be lined with, nonsparking material. There shall be sufficient clearance between the fan rotating element and the fan casing so as to prevent contact.

(6) Sources of ignition such as smoking or open flames are prohibited where 1,1,2-trichloroethane presents a fire or explosion hazard.

(7) 1,1,2-Trichloroethane shall be stored so as not to come in contact with strong oxidizers, strong caustics, and 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 to liquid 1,1,2-trichloroethane. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5) and (a)(6).

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

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

(4) 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 6)(a)(6), where eye contact to liquid 1,1,2-trichloroethane may contact the eyes.

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

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes contaminated with liquid 1,1,2-trichloroethane promptly wash or

shower with soap or mild detergent and water to remove any 1,1,2-trichloroethane from the skin.

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

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

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

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

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

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

(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-trichloroethane or airborne concentrations of 1,1,2-trichloroethane 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) Kidney disease

(ii) Liver 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-trichloroethane which are listed in Appendix A which the employee suspects are caused by exposure to 1,1,2-trichloroethane.

(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-trichloroethane;

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

(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-trichloroethane or would directly or indirectly aggravate any detected medical condition;

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

(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-trichloroethane or airborne concentrations of 1,1,2-trichloroethane 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-trichloroethane.

(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-trichloroethane.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,1,2-trichloroethane 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:

(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-trichloroethane;

(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.

(l) 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-trichloroethane which is conducted pursuant to this section.

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

APPENDIX A

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

I. SUBSTANCE IDENTIFICATION

A. Substance: 1,1,2-Trichloroethane

B. Permissible Exposure: 10 parts of 1,1,2-trichloroethane per million parts of air (ppm) (45 milligrams of 1,1,2-trichloroethane per cubic meter of air, mg/cu m) averaged over an eight-hour shift.

C. Appearance and Odor: Colorless liquid with a sweet odor, like chloroform.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body: 1,1,2-Trichloroethane can affect your body if you inhale it or if it comes in contact with your eyes or if you swallow it. It may be absorbed through your skin.

B. Effects of Overexposure:

1. Short-Term Exposure: 1,1,2-trichloroethane may cause irritation of the eyes and nose, drowsiness, incoordination, unconsciousness and death. It might also cause liver and kidney damage.

2. Long-Term Exposure: Repeated or prolonged exposure to 1,1,2-trichloroethane might cause liver or kidney damage.

3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to 1,1,2-trichloroethane.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If 1,1,2-trichloroethane gets into your eyes, wash the eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. If irritation persists after washing, get medical attention. Contact lenses should not be worn when working with this chemical.

B. Skin Exposure: If 1,1,2-trichloroethane gets on your skin, promptly wash the contaminated skin using soap or mild detergent. If 1,1,2-trichloroethane soaks through your clothing, remove the clothing promptly and wash the skin using soap or mild detergent. If irritation persists after washing, get medical attention.

C. Breathing: If you or any other person breathes in large amounts of 1,1,2-trichloroethane 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-trichloroethane has been swallowed, get medical attention immediately. If medical attention is

not immediately available, get the 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-trichloroethane. 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 there use is required. If you can smell 1,1,2-trichloroethane 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-trichloroethane. Replace or repair impervious protective clothing that has developed leaks.

C. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where 1,1,2-trichloroethane may contact your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. 1,1,2-Trichloroethane vapors, at elevated temperatures, can form explosive mixtures with air.

B. 1,1,2-Trichloroethane must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames, strong oxidizers, strong caustics, and chemically active metals.

C. Sources of ignition such as smoking and open flames are prohibited wherever 1,1,2-trichloroethane is handled, used or stored in a manner that could create a potential fire or explosion hazard.

D. You must promptly remove any non-impervious clothing that becomes contaminated with liquid 1,1,2-trichloroethane and this clothing must not be reworn until the 1,1,2-trichloroethane is removed from the clothing.

E. If your skin becomes contaminated with liquid 1,1,2-trichloroethane, you must promptly wash or shower with soap or mild detergent and water to remove the 1,1,2-trichloroethane from your skin.

F. You must not eat or smoke in areas where liquid 1,1,2-trichloroethane is handled, processed or stored.

G. If you handle liquid 1,1,2-trichloroethane, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

H. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.

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

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES FOR 1,1,2-TRICHLOROETHANE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Vinyl trichloride; beta-trichloroethane
2. Formula: $CHCl_2CH_2Cl$
3. Molecular weight: 133.4

B. Physical Data

1. Boiling point (760 mm Hg): 113 C (236 F)
2. Specific gravity (water = 1): 1.43
3. Vapor density (air = 1 at boiling point of 1,1,2-trichloroethane): 4.55
4. Melting point: -37 C (-34 F)
5. Vapor pressure at 20 C (68 F): 18.8 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.45
7. Evaporation rate (butyl acetate = 1): data not available
8. Appearance and odor: Colorless liquid with a sweet odor, like chloroform

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: none in normal test method.
2. Autoignition temperature: data not available
3. Flammable limits in air, % by volume: Lower: 6.0; Upper: 15.5 (high energy ignition source required)
4. Extinguishing media: Foam, carbon dioxide, dry chemical
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: 1,1,2-Trichloroethane vapors, at elevated temperatures, can form explosive mixtures with air. All ignition sources must be controlled where 1,1,2-trichloroethane is used, handled or stored in a manner that could create a potential fire or explosion hazard.
7. Above 15,000 ppm, one-fourth of the lower flammable limit, is one situation in which 1,1,2-trichloroethane is considered to be a potential fire and explosion hazard.
8. For purposes of complying with 29 CFR 1910.309, the classification of hazardous locations as described in Article 500 of the National Electrical Code for 1,1,2-trichloroethane shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat.

2. Incompatibilities: Contact with strong oxidizers, strong caustics, and chemically active metals such as aluminum and magnesium powders, sodium or potassium may cause fires and explosions.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, phosgene and carbon monoxide) may be released in a fire involving 1,1,2-trichloroethane.
4. Special precautions: Liquid 1,1,2-trichloroethane will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If 1,1,2-trichloroethane is spilled or leaked, the following steps should be taken:
1. Remove all ignition sources.
2. Ventilate area of spill or leak.
3. Collect for reclamation or absorb in vermiculite, dry sand, earth or a similar material.

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

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

IV. MONITORING AND MEASUREMENT PROCEDURES

A. Exposure Above the Action Level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Several short time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84. Portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of 1,1,2-trichloroethane 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-trichloroethane 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-trichloroethane in tightly closed containers in a cool, well-ventilated area.

B. High exposures to 1,1,2-trichloroethane 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-trichloroethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,1,2-trichloroethane is likely to occur are: during its production and its use as an intermediate in a commercial synthesis of vinylidene chloride.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

1,1,2-Trichloroethane vapor is a potent narcotic. Injury to lungs, liver, and kidneys has been observed in animals. The lethal concentration for rats was 2000 ppm for 4 hours. Concentrations resulting in narcosis also caused irritation of the nose and eyes. Mice treated by intraperitoneal injection with anesthetic doses showed moderate hepatic dysfunction and renal dysfunction; at autopsy, there was centrolobular necrosis of the liver, and tubular necrosis of the kidney. No human cases of intoxication or systemic effects from industrial exposure have been reported.

III. SIGNS AND SYMPTOMS

May cause nose and eye irritation, and central nervous system depression.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

In animals, 1,1,2-trichloroethane causes liver and kidney dysfunction. Alcohol intake might increase susceptibility. Skin absorption is known to occur. It is important that the physician become familiar with plant operating conditions in which exposure to 1,1,2 -trichloroethane 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-trichloroethane exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Liver disease -- 1,1,2-Trichloroethane causes liver damage in animals and justifies consideration before exposing persons with impaired liver function.

2. Kidney disease -- 1,1,2-Trichloroethane causes kidney damage in animals and justifies special consideration before exposing persons with impaired renal function.

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-Trichloroethane," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 263.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1288-1291.

3. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 258-260.

4. Klaassen, C. D. and G. L. Plaa: "Relative Effects of Various Chlorinated Hydrocarbons on Liver and Kidney Function on Mice," Toxicology and Applied Pharmacology, 9:139-151, 1966.

REFERENCES AND SOURCES
1,1,2-TRICHLOROETHANE
1910.93

(d) Compliance - Open surface tank classification based on relative evaporation rate of 2.5 hours (from Doolittle)

(e) Fire and Safety

(1) Electrical - Classification based on "Fire Hazard Classification of Chemical Vapors Relative to Explosion-proof Electrical Equipment," H. Carhart et al, National Academy of Sciences, 1973, report to U. S. Coast Guard, report no. CG-D-92-74, p. 20 (analogy to 1,1,1-trichloroethane)

(f) Personal Protective Equipment, and, (h) Sanitation

Eye: Union Carbide, "Toxicology Study for 1,1,2-Trichloroethane"

Skin: Union Carbide, "Toxicology Study for 1,1,2-Trichloroethane;" "Documentation of the Threshold Limit Values," American Conference of Governmental Industrial Hygienists; International Labour Office, "Encyclopedia of Occ. Safety and Health"

Ingestion: Union Carbide, "Toxicology Study for 1,1,2-Trichloroethane;" NIOSH Toxic Substances List 1973; "Documentation of the Threshold Limit Values," American Conference of Government Industrial Hygienists

COMMENTS

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

According to Union Carbide, "flooding the rabbit eye with an excess of the chemical caused a reaction no more severe than moderate inflammation." A classification of 2 is clearly justified.

Skin - Classification: 2
Output statement numbers: 2, 7b, 17g, 17i, 20a
Exceptions: None

Union Carbide reports an LD50 for skin absorption in rabbits of 3.73 ml/kg, where the contact lasted 24 hours and was covered. The report continues "defatting dermatitis may appear after repeated contact." It is also noted that "the undiluted chemical caused redness of short duration on the tender skin of the rabbit belly." The Documentation of TLV states that, by inhalation, oral and subcutaneous administration, it is more potent than chloroform. Also noted is that it is absorbed through intact skin. ILO reports, referring to inhalation, that "the toxicological response from chronic exposure would be qualitatively and quantitatively comparable to carbon tetrachloride." The substance does not have a flashpoint. Its vapor pressure at 20 C is about 19 mm Hg. The primary hazard of skin contact would appear to be absorption through the intact skin. By analogy to carbon tetrachloride and chloroform for effects by skin absorption, a classification of 2 is concluded to be sufficient. The low vapor pressure and toxicity of the substance by inhalation and skin contact indicate a need for statement 7b. Statement 7a is felt to

be unnecessarily stringent in this case.

Ingestion - Classification: 1
Output statement numbers: 19, 20a
Exceptions: None

An oral LD50 for rats of 1.14 g/kg is reported by Union Carbide. An oral rat LD50 of 580 mg/kg is listed in the Toxic Substances List. The ACGIH lists 0.75 g/kg as lethal to dogs by mouth. The report continues, "fatty degeneration of the liver was observed in dogs dying two or more days following administration." No reports of chronic feeding studies could be located in the literature. By analogy to the effects of chloroform and carbon tetrachloride, it is concluded that there is high probability that chronic ingestion of small quantities can at least cause liver and kidney damage and that a classification of 1 is appropriate.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)
Dow Chemical Co., Material Safety Data Sheet (Dow)
Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 5, p. 157 (K-O)

Sources of data items used:

I. A. 1. Synonyms: NFPA-49; Dow
2. Formula: NFPA-49; Dow
3. Molecular weight: ADL
B. 1. Boiling point: NFPA-49; Dow
2. Specific gravity: Dow
3. Vapor density: Dow
4. Melting point: K-O
5. Vapor pressure: Dow
6. Solubility in water: Dow
7. Evaporation rate: data not available
8. Appearance and odor: NFPA-49; Dow

II. A. 1. Flash point: NFPA-49: Dow
2. Autoignition temperature: data not available
3. Flammable limits: Dow
4. Extinguishing media: Dow
5. Special fire fighting procedures: NFPA-49; Dow
6. Unusual fire and explosion hazards: ADL
B. 1. Conditions contributing to instability: ADL
2. Incompatibilities: Dow; ADL
3. Hazardous decomposition products: NFPA-49; Dow
4. Special precautions: ADL

III. A. Steps if released or spilled: Dow; ADL
C. Waste disposal method: Dow

V. Miscellaneous precautions: NFPA-49

VI. Common operations: K-O

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

International Labor Organization, "Encyclopedia of Occupational Health,"

Geneva, 1972 (ILO)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 1st edition, 1954 (Chem Tech)
Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)
"1,1,2-Trichloroethane," Material Safety Data Sheet, The Dow Chemical Company, Midland, Michigan, January 14, 1972 (Dow)

References for Specific Use/Exposure

1. ADL estimate
2. ILO, Chem Tech, SRI

References for Specific Control Methods

Dow was the reference used for the Specific Control Methods

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

RESPIRATOR TABLE DOCUMENTATION

Substance: 1,1,2-Trichloroethane

D. O. L. Standard: 10 ppm

WARNING PROPERTIES:

Odor Threshold: Although 1,1,2-trichloroethane is known to have a sweet, chloroform-like odor, no quantitative data are available concerning the odor threshold of this substance.

Eye Irritation Level: Grant reports that high concentrations of the vapors of 1,1,2-trichloroethane are irritating to the eyes. The concentrations at which this irritation occurs are not stated.

Other Information: Grant reports that high concentrations of the vapors of 1,1,2-trichloroethane are irritating to the respiratory tract, but no quantitative information is given.

Evaluation of Warning Properties: Since no quantitative information is available relating the warning properties to air concentrations of 1,1,2-trichloroethane, this substance has been treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted.

IDLH: 500 ppm

Basis for IDLH Value: This IDLH is based upon the report of Union Carbide Corporation that a 4-hour exposure to 500 ppm 1,1,2-trichloroethane killed 1 out of 6 animals.

Other Toxicological Information: Patty reports that the principal physiological effect of an acute exposure to 1,1,2-trichloroethane is CNS depression. In addition, lung, liver and kidney damage may occur.

Patty states that one investigator determined "an acute lethal concentration LC50 for rats to be 2000 ppm from a 4-hour exposure followed by a 14-day observation period."

The Union Carbide Corporation reports that a 4-hour exposure to 500 ppm 1,1,2-trichloroethane killed 1 out of 6 animals, and an 8-hour exposure to the same concentration killed 4 out of 6 animals. An 8-hour exposure to 2000 ppm killed all of the animals which had been exposed.

The Documentation of TLV's states that 1,1,2-trichloroethane is more narcotic than chloroform. A 2-hour exposure to 13,600 ppm can produce "deep narcosis and death." According to the Documentation, "death occurs from respiratory arrest."

LFL: 60,000 ppm

VAPOR PRESSURE: 18.8 mm Hg at 20 deg. C.
25 mm Hg at 25 deg. C.

SATURATED CONCENTRATION AT: 20 deg. C.: approximately 24,700 ppm
25 deg. C.: approximately 32,900 ppm

USE/EXPOSURE AND CONTROL DOCUMENT
1,1,2-TRICHLOROETHANE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid and vapor during synthesis and handling of substance	A,D	General dilution ventilation; personal protective equipment including self - contained breathing apparatus or face mask with organic canister, safety glasses or gas - tight goggles
2.	Inhalation of vapor and skin contact with liquid and vapor during organic synthesis (primarily in production of vinylidene chloride)	A,D	General dilution ventilation; personal protective equipment including self - contained breathing apparatus of face mask with organic canister, safety glasses or gas - tight goggles

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

Note: 1,1,2-Trichloroethane was used quite extensively in the synthesis of vinylidene chloride but has been replaced by the less toxic 1,1,1-trichloroethane.

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

1,146 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

```
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*
*** JES2 NJE *A*
*** JES2 NJE *A*                                                 *
*** JES2 NJE *A*                                                ***
*** JES2 NJE *A*                                               ** **
*** JES2 NJE *A*                                              **   **
*** JES2 NJE *A*                                             **     **
*** JES2 NJE *A*                                            **       **
*** JES2 NJE *A*                                           **  ****   **
*** JES2 NJE *A*                                          **  **  **   **
*** JES2 NJE *A*                                         **   **   **   **
*** JES2 NJE *A*                                        **    **    **   **
*** JES2 NJE *A*                                       **     **     **   **
*** JES2 NJE *A*                                      **      **      **   **
*** JES2 NJE *A*                                     **       **       **   **
*** JES2 NJE *A*                                    **        **        **   **
*** JES2 NJE *A*                                   **         **         **   **
*** JES2 NJE *A*                                  **          **        **     **
*** JES2 NJE *A*                                 **           **       **       **
*** JES2 NJE *A*                                **            **      **         **
*** JES2 NJE *A*                               **             **     **           **
*** JES2 NJE *A*                              **              **    **             **
*** JES2 NJE *A*                             **               **   **               **
*** JES2 NJE *A*                            **                **  **                 **
*** JES2 NJE *A*                           **   **            ** **             **    **
*** JES2 NJE *A*                          **   ****           ****             ****    **
*** JES2 NJE *A*                         **   **   **         **              **  **    **
*** JES2 NJE *A*                        **   **     **        **             **    **    **
*** JES2 NJE *A*                       **   **                **            **            **
*** JES2 NJE *A*                      **   **                 **           **              **
*** JES2 NJE *A*                     **   **                  **          **                **
*** JES2 NJE *A*                    **   **                   **         **                  **
*** JES2 NJE *A*                   **   **                    **        **                    *
*** JES2 NJE *A*                  **   **                     **       **
*** JES2 NJE *A*                 **   **                **    **      **                  **
*** JES2 NJE *A*                **   **                  **   **     **                    **
*** JES2 NJE *A*               **    ***********************  **     *************************
*** JES2 NJE *A*              **     ***********************  **     *************************
*** JES2 NJE *A*             **                               **
*** JES2 NJE *A*            **
*** JES2 NJE *A*           ********************************************************************
*** JES2 NJE *A*          *********************************************************************
*** JES2 NJE *A*
*** JES2 NJE *A*
*** JES2 NJE *A*
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
*** JES2 NJE *A*    FWMMITS  OSH     JOB  174     END     PRINTER8   MITS-PERIF-0205     11.03.03
```