NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND SUPPORTING DOCUMENTATION FOR

*** 1,2-DICHLOROETHYLENE ***

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

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 1,2-DICHLOROETHYLENE.

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 1,2-DICHLOROETHYLENE

(a) Definitions.

(1) "Permissible exposure" means inhalation of 1,2-dichloroethylene in concentrations not in excess of 200 parts per million (ppm) (790 milligrams per cubic meter, mg/cu.m.) averaged over an eight-hour work shift, as stated in $$ 1910.93, Table G-1.

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

(b) Exposure determination and measurement.

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

(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 1,2-dichloroethylene;

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

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

below the action level, the employer may terminate measurement for the employee.

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

(c) Methods of measurement.

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

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

Table 1

Concentration	Required Accuracy
Above permissible exposure	± 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 1,2-dichloroethylene above the permissible exposure as defined in paragraph (a)(1) of this section.

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

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94 (d), operations involving 1,2-dichloroethylene shall be classified as B-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 1,2-dichloroethylene to at or below the permissible exposure; or

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

(v) In emergencies.

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

TABLE 2 RESPIRATORY PROTECTION FOR 1, 2 - DICHLOROETHYLENE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
1000 ppm or less	A chemical cartridge respirator with full facepiece and organic vapor cartridge(s).
4000 ppm or less	A gas mask with a chin-style or front- or back-mounted organic vapor canister.
	any supplied-air respirator with a full facepiece, helmet, or hood.
	Any self-contained breathing apparatus with a full facepiece.
Greater than 4000 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 1,2-dichloroethylene.

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

(3) For the purpose of compliance with $ 1910.157, 1,2-dichloroethylene 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 1,2-dichloroethylene shall be Class I, Group D.

(5) For the purpose of compliance with $ 1910.106, liquid 1,2-dichloroethylene is classified as a Class IB flammable liquid.

(6) Where a fan is located in ductwork and where 1,2-dichloroethylene is present in the ductwork in concentrations greater than 24000 ppm (25% 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.

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

(8) 1,2-dichloroethylene shall be stored so as not to come in contact with strong

(f) Personal protective equipment.oxidizers.

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

(3) Employers shall ensure that clothing which becomes wet with liquid 1,2-dichloroethylene be removed immediately and not reworn until the 1,2-dichloroethylene 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(a)(2)-(a)(6) where liquid 1,2- dichloroethylene may contact the eyes.

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

(2) Liquid 1,2-dichloroethylene shall not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

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

(i) Training and information. (1) Each employer who has a workplace in which 1,2-dichloroethylene is present shall keep a copy of this regulation with Appendices 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 1,2-dichloroethylene above the action level or employees who may have skin or eye contact with liquid 1,2-dichloroethylene, or employees who work where 1,2-dichloroethylene presents a potential fire or explosion hazard shall annually:

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

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

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

(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 1,2-dichloroethylene.

(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 1,2-dichloroethylene or airborne concentrations of 1,2-dichloroethylene 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) Liver disease

(ii) Chronic lung disease

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

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

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to 1,2dichloroethylene which are listed in

Appendix A which the employee suspects are caused by exposure to 1,2-dichloroethylene.

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

(i) A copy of this regulation with Appendices A, B and C for 1,2-dichloroethylene;

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

(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 level; 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 1,2-dichloroethylene or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to 1,2-dichloroethylene including limitations upon the use of 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 1,2-dichloroethylene.

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

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

(8) The employer shall provide emergency medical treatment for any employee injured through exposure to 1,2-dichloroethylene.

(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 1,2-dichloroethylene.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,2-dichloroethylene 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) This 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 1,2-dichloroethylene;

(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 1,2-dichloroethylene which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to 1,2-dichloroethylene 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 1,2-dichloroethylene 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 1,2-DICHLOROETHYLENE

I. SUBSTANCE IDENTIFICATION

A. Substance: 1,2-Dichloroethylene

B. Permissible Exposure: 200 parts of 1,2-dichloroethylene per million parts of air (ppm) or 790 milligrams of 1,2-dichloroethylene per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.

C. Appearance and Odor: Colorless liquid with an ether-like, slightly acrid odor like chloroform.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body:
1,2-Dichloroethylene 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. Exposure to 1,2-dichloroethylene may cause dizziness, drowsiness and unconsciousness.

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

III. EMERGENCY FIRST AID PROCEDURES

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

B. Skin Exposure: If 1,2-dichloroethylene gets on your skin, promptly wash the contaminated skin using soap or mild detergent and water. If 1,2-dichloroethylene soaks through your clothing, remove the clothing immediately 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 1,2-dichloroethylene, 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 immediately.

D. Swallowing: When 1,2-dichloroethylene 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 1,2-dichloroethylene. 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 1,2-dichloroethylene 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 1,2-dichloroethylene. 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 1,2-dichloroethylene may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. 1,2-Dichloroethylene is a flammable liquid and its vapors easily form explosive mixtures with air.

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

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

D. You must use non-sparking tools when opening or closing containers of 1,2-dichloroethylene and containers must be bonded when pouring or transferring liquid 1,2-dichloroethylene.

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

F. Clothing wet with liquid 1,2-dichloroethylene can be easily ignited. You must immediately remove this clothing and it must not be reworn until the 1,2-dichloroethylene is removed from the clothing.

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

H. Ask your supervisor where 1,2-dichloroethylene 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 1,2-dichloroethylene and to instruct you in the safe and correct use of protective equipment.

B. Your employer is required to determine whether you are being overexposed to 1,2-dichloroethylene. You or your representative has the right to observe employee exposure measurements and to be informed of the results.

C. Your employer is required to release your exposure determination and medical records to your physician upon written request from your physician.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES FOR 1,2-DICHLOROETHYLENE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Acetylene dichloride; cis-acetylene dichloride; dioform; trans-acetylene dichloride; sym-dichloroethylene
2. Formula: ClCH=CHCl
3. Molecular weight: 96.9

B. Physical Data

1. Boiling point (760 mm Hg): 45 - 60 C (113 - 140 F)
2. Specific gravity (Water = 1): 1.27
3. Vapor density (air = 1 at boiling point of 1,2-dichloroethylene): 3.34
4. Melting point: -49 to -81.5 C (-56 to -115 F)
5. Vapor pressure at 20 C (68 F): 180 - 265 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.35 - 0.63
7. Evaporation rate (butyl acetate = 1): data not available
8. Appearance and odor: Colorless liquid with an ether-like, slightly acrid odor, like chloroform

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 2.2 - 3.9 C (36 F - 39 F) (closed cup)
2. Autoignition temperature: 460 C (860 F) for trans-1,2 dichloroethylene
3. Flammable limits in air, % by volume: Lower: 9.7; Upper: 12.8
4. Extinguishing media: Dry chemical, foam, carbon dioxide
5. Special fire-fighting procedures: Do not use a solid stream of water since the stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: 1,2-Dichloroethylene is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where 1,2-dichloroethylene is handled, used or stored. 1,2-Dichloroethylene vapors are heavier than air and may travel along the ground and be ignited by open flames or sparks at locations remote from the site at which 1,2-dichloroethylene is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, 1,2-dichloroethylene is classified as a Class IB flammable liquid. At 24000 ppm, one-fourth of the lower flammable limit, 1,2-dichloroethylene 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 1,2-dichloroethylene shall be Class I Group D.

B. Reactivity

1. Conditions contributing to instability: Heat

2. Incompatibilities: Contact with strong oxidizers 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 1,2-dichloroethylene.

4. Special precautions: 1,2-Dichloroethylene will attack some forms of plastics, rubber and coatings

III. SPILL, LEAK AND DISPOSAL PROCEDURES

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

1. Remove all ignition sources

2. Ventilate area of spill or leak

3. For small quantities, absorb on paper towels. Evaporate in a safe place (such as a fume hood). Allow sufficient time for vapors to completely clear hood duct work, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. 1,2-Dichloroethylene may not be allowed to enter a confined space, such as a sewer, because of the possibility of an explosion.

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

C. Waste disposal methods:
1,2-Dichloroethylene may be disposed of by atomizing in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device.

IV. MONITORING AND MEASUREMENT PROCEDURES

A. Exposure Above the Action Level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Several short term interval samples (up to 30 minutes) may also be used to determine 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 1,2 dichloroethylene to plus or minus 35%.

B. Exposure Above the Permissible Exposure: The monitoring under this section should be essentially the same as described under paragraph (IV)(A). Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement

must determine the concentration of 1,2 dichloroethylene to plus or minus 25%.

C. Methods meeting these accuracy requirements are available from NIOSH.

D. 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 1,2-dichloroethylene in tightly closed containers in a cool, well-ventilated area.

B. High exposures to 1,2-dichloroethylene can occur when transferring the liquid from one container to another.

C. Non-sparking tools must be used to open and close metal 1,2-dichloroethylene containers. These containers must be effectively grounded and bonded prior to pouring.

D. Employers should advise employees of all areas and operations where exposure to 1,2-dichloroethylene could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,2-dichloroethylene is likely to occur are: during its use as special solvent for extraction of heat sensitive substances; in the preparation of rubber solutions; as an additive to certain dye and lacquer solutions; as a solvent; in chemical synthesis of polymers and telomers; and during its production.

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

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

1,2-Dichloroethylene vapor is a narcotic and a mucous membrane irritant. Variations in toxicity of the cis- as compared to the trans-form have been reported. A concentration of 39,000 ppm was lethal to guinea pigs and narcosis was produced at 18,000 ppm. Dogs exposed to high concentrations of vapor developed superficial corneal turbidity which was reversible. No effects were observed in several species with repeated exposure for up to 6 months at 1,000 ppm. It has been used as a general anesthetic in man; one industrial fatality was due to very high vapor inhalation in a small enclosure.

III. SIGNS AND SYMPTOMS

Irritation of eyes and respiratory tract; at high levels, may produce central nervous system depression.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of 1,2-dichloroethylene are caused by its narcotic and irritant properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to 1,2-dichloroethylene 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 1,2-dichloroethylene exposure. Only those

giving a positive history of these conditions must be referred for further medical examinations.

1. Liver disease -- Although 1,2-dichloroethylene is not known as a liver toxin in humans, the importance of this organ in the biotransformation and detoxification of foreign substances should be considered before exposing persons with impaired liver function.

2. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,2-dichloroethylene might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

Routine periodic examinations are not required. However, if the employer becomes aware of an employee with the above listed conditions, he must refer such employee for further medical examination.

References

1. American Conference of Governmental Industrial Hygienists: "1,2-Dichloroethylene," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 80.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1307-1309.

3. von Oettingen, W. F.: The Halogenated Aliphatic, Olefinic, Cyclic, Aromatic, and Aliphatic-Aromatic Hydrocarbons Including the Halogenated Insecticides, Their Toxicity and Potential Dangers, U.S. Public Health Service Publication No. 414, U.S. Government Printing Office, Washington, D.C., 1955, pp. 198-202.

4. Smyth, Henry F., Jr.: "Improved Communication--Hygienic Standards for Daily Inhalation," American Industrial Hygiene Association Quarterly, 17:154, 1956.

5. Grant, W. Morton: Toxicology of the Eye (2d ed), Charles C. Thomas Illinois, 1974, pp. 371-372.

REFERENCES AND SOURCES
1,2 - DICHLOROETHYLENE
1910.93

(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. 31.

(2) Open Surface Tanks - Open surface tank classification based on boiling point of 113 F and guidelines found in Ansi Z9.1-1971, "Practices for ventilation and operation of open surface tanks," P. 19.

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

Eye: Kirk-Othmer, "Encyclopedia of Chemical Technology," edition 1, and Grant, "Toxicology of the Eye"

Skin: American Conference of Governmental Industrial Hygienists, "Documentation of the Threshold Limit Values," Sax, "Dangerous Properties of Industrial Materials"

Ingestion: American Conference of Governmental Industrial Hygienists. "Documentation of the Threshold Limit Values;" NIOSH, "The Toxic Substances List 1974" and Sax, "Dangerous Properties of Industrial Materials"

COMMENTS

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

Kirk-Othmer states that 1,2-dichloroethylene has specific irritant action on the cornea describing it as "lacrimation followed by corneal opacity." Reference to Grant indicates that Kirk-Othmer is probably referring to the effects of vapor contact. Grant further states that, "The effects of 1,2-dichloroethylene on the cornea have been much less than those observed with 1,2-dichloroethane", for which it is reported that, "Twenty cases of corneal burns have been listed as caused by dichloroethane in workmen, presumably from splashes, but all recovered quickly. On rabbit eyes the reaction to a drop of dichloroethane at 24 hours has been graded 3 on a scale of 1 to 10." On this basis the eye classification is given a rating of 2.

Skin - Classification: 2
Output statement numbers: 2, 7b, 16i, 21
Exceptions: None

Documentation of TLV's reports work showing no effect of 1,2-dichloroethylene when applied to the shaved skin on the back of rats or when the tails were immersed in 25 - 100% concentrate solutions. The Toxic Substances List shows the rabbit LD50 to be 3890 mg/kg to the skin. Sax states that it is a slight irritant in chronic local exposures; it is moderately toxic in acute systemic exposures through skin absorption. Its flash point is 36 F. Its vapor pressure at 20 C is between 180 to 265 mm Hg which indicates it is very volatile.

Ingestion - Classification: 0
Output statement numbers: None
Exceptions: None

Work reported in the Documentation of TLV's found no effect of 1,2-dichloroethylene when rats were tested for gastrointestinal absorption of 1.4 - 20 g/kg in single doses; and in chronic absorption studies at 0.05, 0.25 and 0.5 and 1 g/kg over seven weeks. The oral rat LD50 is stated to be 770 mg/kg in the Toxic Substances List. Sax lists the systemic effects of an acute ingestion exposure as moderate and of a chronic ingestion exposure as slight.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)

Eastman Kodak Co., Material Safety Data Sheets (Eastman)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 5, p. 180 (K-O)

"Beilstein's Handbuch der Organischem Chemie," Vol. 1, p. 187 and supplements (Beilstein)

Sources of data items used:

I. A. 1. Synonyms: NFPA-325M; K-O
2. Formula: K-O
3. Molecular weight: ADL

B. 1. Boiling point: K-O
2. Specific gravity: NFPA-325M; Eastman
3. Vapor density: NFPA-325M; Eastman
4. Melting point: K-O
5. Vapor pressure: K-O
6. Solubility in water: Beilstein
7. Evaporation rate: data not available
8. Appearance and odor: NFPA-49; K-O

II. A. 1. Flash point: NFPA-325M; K-O
2. Autoignition temperature: NFPA-325M
3. Flammable limits: NFPA-325M
4. Extinguishing media: NFPA-49; Eastman
5. Special fire fighting procedures: NFPA-325M and -49
6. Unusual fire and explosion hazards: NFPA-49

B. 1. Conditions contributing to instability: analogy
2. Incompatibilities: NFPA-49
3. Hazardous decomposition products: Eastman
4. Special precautions: analogy

III. A. Steps if released or spilled: NFPA-49; Eastman

C. Waste disposal method: Eastman; ADL

V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of the document:

"Chemical Abstracts," American Chemical Society, 75:P150585(1971), 66:18040(1967), 67:P101325(1967), 68:P88428(1968), 68:P30914(1968), 71:P75601(1969), 68:P60035(1968), 77:P141365(1972), 77:P125942(1972), 76:P25804(1972) (CA)

"1,2 - Dichloroethylene," Eastman Kodak Company, Material Safety Data

Sheet, 1973 (MSDS)
Jacobs, M. B., "The Analytical Chemistry of Industrial Poisons, Hazards, and Solvents," Second edition, Interscience Publishers, Inc., 1949 (Jacobs)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 1st edition, 1954 (Chem Tech)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 2nd edition, 1972 (K-O)
McBirney, R. S., "Trichloroethylene and Dichloroethylene Poisoning," Industrial Hygiene and Occupational Health, 10:130 - 133 (1954) (McBirney)
Mellan, I., "Source Book of Industrial Solvents," Vol. II, Reinhold Publishing Corp., 1957 (Mellan)

References for Specific Use/Exposure

1. K-O, McBirney
2. CA, K-O
3. Jacobs, Mellan
4. Chem Tech, Jacobs, Mellan
5. K-O
6. CA, K-O
7. CA, Jacobs
8. ADL estimate

References for Specific Control Methods

1. MSDS
2. ADL estimate, MSDS
3. MSDS
4. MSDS
5. ADL estimate
6. ADL estimate, MSDS
7. MSDS
8. MSDS

RESPIRATOR TABLE JUSTIFICATION

According to Patty, CNS depression is the principal effect of exposures to cis- and trans-1,2 - dichloroethylene. Patty notes that in an acute vapor exposure experiment, rats exposed to the cis - isomer for 4 hours at 8000 ppm were neither killed nor anesthetized, but at 16,000 ppm anesthesia occurred in 8 minutes and death occurred in 4 hours. According to this investigator mentioned by Patty, the "trans - isomer was twice as toxic and anesthetic as the cis - isomer."

Deichman and Gerarde state that 1,2 - dichloroethylene in a concentration of 20,000 - 25,000 ppm for a 2-hour exposure is fatal or can produce serious injury after a 2-hour exposure.

Stecher reports that the lethal concentration in air for mice is 15,000 ppm.

The ILO states that there is disagreement concerning the relative toxicities of the 2 isomers and also concerning whether or not liver or kidney damage results following exposures to high concentrations. The ILO notes that one fatal case from an industrial exposure has been reported in the literature.

WARNING PROPERTIES: Staub reports an odor threshold of .085 ppm for dichloroethylene. For the purposes of this standard, 1,2-dichloroethylene is treated as a material with adequate warning properties.

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

EYE IRRITATION: 1,2 - dichloroethylene is an eye irritant, according to Grant, but the concentrations at which irritation occurs are not mentioned.

IDLH: Based upon the report by Patty that rats exposed to the cis-isomer for 4 hours at 8000 ppm were neither killed nor anesthetized, but at 16,000 ppm anesthesia occured in 8 minutes and death occurred in 4 hours, an IDLH concentration of 4000 ppm is assumed for 1,2-dichloroethylene, since Patty notes that "the trans-isomer was twice as toxic and anesthetic as the cis-isomer."

LFL: The lower flammable limit of 1,2 - dichloroethylene is 97,000 ppm

PERMISSIBLE EXPOSURE: 200 ppm.

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

USE/EXPOSURE AND CONTROL DOCUMENT
1,2 - DICHLOROETHYLENE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use as a low temperature solvent for heat sensitive substances (extraction of caffeine from coffee, perfume oils from flowers, oils from fish, fats from flesh of animals)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
2.	Inhalation of vapor and skin contact with liquid during use in the rubber and dye industries (rubber solutions and polymers, dye extraction and application)	A,B	Process enclosure (depending on procedure); local exhaust ventilation; personal protective equipment (gloves, goggles)
3.	Inhalation of vapor and skin contact with liquid during use as a direct solvent (gums, waxes, oils, camphor, phenol)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
4.	Inhalation of vapor and skin contact with liquid during use in solvent mixtures (with methyl alcohol, ethyl alcohol or alkyl acetates it shows a pronounced solvency for ester and ether derivatives - lacquers, resins, thermoplastics, artificial fibers)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
5.	Inhalation of vapor and skin contact with liquid during the manufacture of 1,2 - dichloroethylene (Reduction of 1,1,2,2 - tetrachloroethane - high percentage of cis isomer or chlorination of acetylene - high percentage of trans isomer) The marketed product is generally a mixture of the cis and trans isomers. The isomers can be separated	A,B	Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)

	by fractional distillation but this would be too expensive a procedure for industrial purposes.		
6.	Inhalation of vapor and skin contact with liquid during use in organic synthesis. This compound is relatively inert chemically but can be used to synthesize certain chemicals, polymers and telomers with the use of proper catalysts.	A,B	Process enclosure (depending on procedure); local exhaust ventilation; personal protective equipment (gloves, goggles)
7.	Inhalation of vapor and skin contact with liquid during miscellaneous applications (liquid dry cleaning agent, cleaning solution for printed circuit boards, food packaging adhesives, insecticidal and germicidal fumigants	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
8.	Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage vessels and during clean up of accidental spills	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles, respiratory protective devices)

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

Note -- 1,2 - Dichloroethylene is of minor technological importance. It is found in industry but not too often since other products are less toxic and economically more feasible.