

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** 1,1-DICHLOROETHANE ***

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

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-DICHLOROETHANE.

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

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

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(a) Definitions.

(1) "Permissible exposure" means inhalation of 1,1-dichloroethane in concentrations not in excess of 100 parts per million (ppm) (400 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-dichloroethane.

(b) Exposure determination and measurement.

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

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

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

(ii) Any measurements of 1,1-dichloroethane taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to 1,1-dichloroethane; 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-dichloroethane 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-dichloroethane 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-dichloroethane 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-dichloroethane 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-dichloroethane 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-dichloroethane below the action level, the employer may terminate measurement for the employee.

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

(c) Methods of measurement.

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

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

Table 1

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

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

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

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving 1,1-dichloroethane 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

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- (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-dichloroethane 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 - DICHLOROETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION

Vapor Concentration	
1000 ppm or less	Any chemical cartridge respirator with organic vapor cartridge(s).
	Any supplied-air respirator.
	Any self-contained breathing apparatus.
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.
	A Type C supplied air respirator with a half-mask operated in pressure-demand or other positive pressure or continuous-flow mode.
	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

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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-dichloroethane.

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

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

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

(6) Dip tank operations shall be performed in accordance with §§ 1910.108 and 1910.94(d).

(7) Where a fan is located in ductwork and where 1,1-dichloroethane is present in the ductwork in concentrations greater than 15,000 ppm (approximately 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.

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

(9) 1,1-Dichloroethane shall be stored so as not to come in contact with strong oxidizers and strong caustics.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid 1,1-dichloroethane. 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-dichloroethane is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of 1,1-dichloroethane from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the 1,1-dichloroethane, the employer shall

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inform the person performing the operation of the hazardous properties of 1,1-dichloroethane.

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

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

(2) Liquid 1,1-dichloroethane 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 1,1-dichloroethane immediately wash or shower with soap or mild detergent and water to remove any 1,1-dichloroethane from the skin.

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

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

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

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

(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-dichloroethane or airborne concentrations of 1,1-dichloroethane 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

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(ii) Liver disease*

(iii) Chronic lung disease

(iv) Skin 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-dichloroethane which are listed in Appendix A which the employee suspects are caused by exposure to 1,1-dichloroethane.

(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-dichloroethane;

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

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

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

(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-dichloroethane or airborne concentrations of 1,1-dichloroethane 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-dichloroethane.

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(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-dichloroethane.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to 1,1-dichloroethane 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:

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- (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-dichloroethane;
 - (C) A copy of information provided to the physician pursuant to paragraph (j)(4)(ii), (iii), (iv), (v), and (vi) of this section.
 - (D) Physician's written opinion; and
 - (E) A signed statement of any refusal to be examined.
- (iii) This record shall be maintained for the duration of the employment of the affected employee.
- (6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.
- (ii) Employee exposure determination and exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
- (iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
- (1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to 1,1-dichloroethane which is conducted pursuant to this section.
- (2) When observation of measurement of employee exposure to 1,1-dichloroethane 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-dichloroethane 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.

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APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR 1,1-DICHLOROETHANE

I. SUBSTANCE IDENTIFICATION

- A. Substance: 1,1-Dichloroethane
- B. Permissible Exposure: 100 parts of 1,1-dichloroethane per million parts of air (ppm) or 400 milligrams of 1,1-dichloroethane per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid with a chloroform-like odor.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: 1,1-Dichloroethane can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also
- B. Effects of Overexposure:
 - 1. Short-Term Exposure: Breathing 1,1-dichloroethane vapor may cause drowsiness and unconsciousness. It might also cause damage to the liver, kidneys and lungs. Splashing the liquid in the eyes may cause irritation.
 - 2. Long-Term Exposure: Prolonged, confined or repeated skin contact with 1,1-dichloroethane can produce a slight burn.
 - 3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to 1,1-dichloroethane.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If 1,1-dichloroethane gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If 1,1-dichloroethane gets on your skin, promptly flush the contaminated skin using soap or mild detergent and water. If 1,1-dichloroethane soaks through your clothing, remove the clothing immediately and flush the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of 1,1-dichloroethane, 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-dichloroethane has been swallowed get medical attention immediately. If medical attention is not immediately available get the affected person to vomit by

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

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. 1,1-Dichloroethane is a flammable liquid and its vapors easily form explosive mixtures with air.
- B. 1,1-Dichloroethane must be stored in tightly closed containers in a cool, well-ventilated area away from heat, sparks, flames, strong oxidizers, and strong caustics.
- C. Sources of ignition such as smoking and open flames are prohibited wherever 1,1-dichloroethane 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 metal containers of 1,1-dichloroethane, and containers must be bonded and grounded when pouring or transferring liquid 1,1-dichloroethane.

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- E. If your skin becomes wet with liquid 1,1-dichloroethane, you must immediately wash or shower using soap or mild detergent and water to remove any 1,1-dichloroethane from the skin.
- F. Clothing wet with 1,1-dichloroethane can easily be ignited. You must immediately remove this clothing and it must not be reworn until the 1,1-dichloroethane is removed from the clothing.
- G. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- H. Ask your supervisor where 1,1-dichloroethane 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-dichloroethane. In addition, your employer must instruct you in the safe use of 1,1-dichloroethane, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to 1,1-dichloroethane. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR 1,1-DICHLOROETHANE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: asymmetrical dichloroethane; ethylidene chloride; 1,1-ethylidene dichloride
2. Formula: CH_3CHCl_2
3. Molecular weight: 99

B. Physical Data

1. Boiling point (760 mm Hg): 57.3 C (135 F)
2. Specific gravity (Water = 1): 1.2
3. Vapor density (air = 1 at boiling point of 1,1-dichloroethane): 3.4
4. Melting point: -96.7 C (-142 F)
5. Vapor pressure at 20 C (68 F): 182 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): less than 0.1
7. Evaporation rate (butyl acetate = 1): 11.6
8. Appearance and odor: Colorless liquid with a chloroform-like odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: -8.5 C (17 F) (closed cup)
2. Autoignition temperature: data not available
3. Flammable limits in air, % by volume: Lower: 5.9; Upper: 15.9
4. Extinguishing media: Foam, dry chemical, 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: 1,1-Dichloroethane is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where 1,1-dichloroethane is handled, used or stored in a manner that may create a potential fire or explosion hazard. 1,1-Dichloroethane 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 1,1-dichloroethane handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, 1,1-dichloroethane is classified as a Class IB flammable liquid. For example, above 15,000 ppm, one-fourth the lower flammable limit, is one of the

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situations in which 1,1-dichloroethane 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-dichloroethane 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. Contact with strong caustics will cause formation of flammable and toxic acetaldehyde gas.
3. Hazardous decomposition products: Toxic gases and vapors (such as vinyl chloride, hydrogen chloride, phosgene and carbon monoxide) may be released in a fire involving 1,1-dichloroethane.
4. Special precautions: 1,1-Dichloroethane will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If 1,1-dichloroethane 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 ductwork, then burn the paper. Large quantities can be collected and atomized in a suitable combustion chamber equipped with an appropriate effluent gas cleaning device. 1,1-Dichloroethane 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: 1,1-Dichloroethane 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 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

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must determine the concentration of 1,1-dichloroethane 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-dichloroethane 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-dichloroethane in tightly closed containers in a cool, well-ventilated area.
- B. High exposures to 1,1-dichloroethane can occur when transferring the liquid from one container to another.
- C. Non-sparking tools must be used to open and close metal 1,1-dichloroethane 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 1,1-dichloroethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to 1,1-dichloroethane is likely to occur are: during its use as a solvent for dewaxing and extraction; in the manufacture of rubber, silicone oils and greases and vinyl chloride; as a fumigant; and as a chemical intermediate.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

1,1-Dichloroethane vapor is a narcotic. Rats exposed to 32,000 ppm for 30 minutes did not survive. The most consistent findings in animals exposed to concentrations of above 8,000 ppm for up to 7 hours were pathologic changes in the kidney and liver, and at much higher concentrations, near 64,000 ppm, damage to the lungs as well. Repeated daily exposure of several species to 1,000 ppm resulted in no pathologic or hematologic changes. The liquid applied to the intact or abraded skin of rabbits produced slight edema and very slight necrosis after the 6th of 10 daily applications. Instilled in the eyes of rabbits there was immediate, moderate conjunctival irritation and swelling which subsided within a week. There have been no reported cases of human overexposure by inhalation; prolonged, confined, or repeated skin contact can produce a slight burn.

III. SIGNS AND SYMPTOMS

May cause central nervous system depression; skin irritation.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. If skin contact has occurred, remove contaminated clothing and wash skin with soap and water. Flush eyes with water. If swallowed and the person is conscious, induce vomiting.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

In animals at very high concentrations it produces central nervous system depression. Most reported effects of 1,1 -dichloroethane are caused by its narcotic properties. It is important that the physician becomes familiar with plant operating conditions in which exposure to 1,1 -dichloroethane 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

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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-dichloroethane exposure. Only those giving a positive history of these conditions must be referred for further medical examinations.

1. Skin disease -- 1,1-Dichloroethane can cause dermatitis on prolonged exposure. Persons with preexisting skin disorders may be more susceptible to the effects of this agent.
2. Liver disease -- Although 1,1-dichloroethane 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.
3. Kidney disease -- Although 1,1-dichloroethane is not known as a kidney toxin in humans, the importance of this organ in the elimination of toxic substances justifies special consideration in those with impaired renal function.
4. Chronic respiratory disease -- In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of 1,1-dichloroethane might cause exacerbation of symptoms due to its irritant properties.

C. PERIODIC EXAMINATIONS

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

References

1. American Conference of Governmental Industrial Hygienists: "1,1-Dichloroethane (Ethylidene Chloride)," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 310.
2. Hygienic Guide Series: "1,1-Dichloroethane (Ethylidene Chloride)," American Industrial Hygiene Association Journal, 32:6771, 1971.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1279-1280.

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REFERENCES AND SOURCES

1,1 - DICHLOROETHANE

1910.93

- (d) Compliance - Open surface tank classification based on relative evaporation rate of 0.65 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. 31.
- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Elkins, "The Chemistry of Industrial Toxicology;" Grant, "Toxicology of the Eye"
- Skin: Kirk-Othmer, "Encyclopedia of Chemical Technology," Browning, "Toxicity and Metabolism of Industrial Solvents;" Elkins, "The Chemistry of Industrial Toxicology;" Patty, "Industrial Hygiene and Toxicology;" Sax, "Dangerous Properties of Industrial Materials"

Ingestion: Toxic Substances List 1974

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

As the literature varies in the comparative toxicity of ethylidene chloride and ethylene dichloride (from half as toxic to as toxic), it is assumed to be as toxic; this is supported by Elkins. Therefore, by analogy with ethylene dichloride, it is expected that liquid contact with the eye will cause "immediate discomfort and hyperemia of the conjunctiva and slight corneal epithelial disturbance may result, but the eyes return to normal in a day or two," as outlined by Grant for ethylene dichloride.

Skin - Classification: 2

Output statement numbers: 2, 7b, 14i, 21

Exceptions: see below

Due to the use of 1,1 - dichloroethane as a high volatility solvent (Kirk-Othmer), it is concluded that it has a drying effect on the skin and dermatitis may result from repeated or prolonged contact. Sax lists it as having slightly toxic properties in acute local exposures. Browning reports work which shows that skin absorption takes place. As the literature varies in the comparative toxicity of ethylidene chloride and ethylene dichloride (from half as toxic to as toxic), it is assumed to be as systemically toxic; this assumption is supported by Elkins. By analogy then, the rabbit LD50 of 2.8 g/kg by skin absorption cited by Patty for ethylene dichloride may be taken as an indication of the toxicity of ethylidene chloride. Patty continues "when ethylene dichloride is held close to the skin within a cuff, quite severe irritation and moderate edema and necrosis may be observed." Patty also states that repeated or prolonged contact causes dermatitis. The flash-

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point of the substance is -8.5 C. Its vapor pressure is 182 mm Hg at 20 C.

The effects and properties of this substance as derived from the above analysis require a special set of output statements. Consequently, statement 2 is used to prevent prolonged or repeated contact which might lead to excessive skin absorption or irritation. Statement 7b is needed because the substance is highly flammable. Though it has been deduced that the substance might be readily absorbed through the skin, statement 7a, which is more stringent, is not specified because of the high volatility of the substance. Since the substance is highly volatile. Statement 21 is felt to be sufficient to minimize the skin absorption hazard, to prevent contained contacts which can cause severe irritation, necrosis, etc., and to protect against the flammability hazard normally associated with specification of this statement. However, in the sanitation part of the standard, a combination of 14 and 16 is felt most appropriate, again because of the volatility of the substance. The statement included requires that skin that becomes "wet" be "immediately" cleansed. Statement 20 is deleted because of high volatility.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

The Toxic Substances List records an oral rat LD50 of 725 mg/kg. Due to its high vapor pressure and relative evaporation rate (11.6), it seems unlikely that 1,1 - dichloroethane would pose an ingestion problem in an industrial situation.

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 USA, "Dow Products and Services" (Dow)
- Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 5, p. 148 (K-O)
- Kirk-Othmer, "Encyclopedia of Chemical Technology," 1st edition, Vol. 12, p. 678 (K-O-1)

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: NFPA-325M; Dow; K-O
- 2. Specific gravity: NFPA-325M; Dow
- 3. Vapor density: ADL
- 4. Melting point: Dow; K-O
- 5. Vapor pressure: K-O
- 6. Solubility in water: Dow
- 7. Evaporation rate: K-O-1
- 8. Appearance and odor: Dow; K-O
- II. A. 1. Flash point: K-O

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2. Autoignition temperature: data not available
3. Flammable limits: K-O
4. Extinguishing media: NFPA-325M; ADL
5. Special fire fighting procedures: NFPA-325M
6. Unusual fire and explosion hazards: ADL
- B. 1. Conditions contributing to instability: ADL
2. Incompatibilities: K-O
3. Hazardous decomposition products: K-O; ADL
4. Special precautions: ADL
- III. A. Steps if released or spilled: NFPA-325M; ADL
- C. Waste disposal method: ADL
- V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of this document include:

- "Documentation of Threshold Limit Values," 1971 (ACGIH)
- "1,1 - Dichloroethane," American Industrial Hygiene Association, Hygienic Guide Series, Jan. 1971 (Hygienic Guides)
- Hamilton, A. and Hardy, H. L., "Industrial Toxicology," Publishing Sciences Group, Inc., 3rd edition, 1974 (Hamilton and Hardy)
- Hawley, Gessner G. "The Condensed Chemical Dictionary," Van Nostrand Reinhold Co., New York, 1971 (Hawley)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
- Kirk, R. E. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 2nd edition, 1972 (K-O)
- Sax, N. Irving, "Dangerous Properties of Industrial Materials," Reinhold Book Corp., New York, 1968 (Sax)
- Jacobs, M. B., "The Analytical Chemistry of Industrial Poisons, Hazards, and Solvents," Interscience Publishers, Inc., New York, 1949 (Jacobs)

References for Specific Use/Exposure

1. K-O, Hawley, Hamilton and Hardy
2. K-O, Hawley, Hamilton and Hardy
3. Hawley
4. K-O
5. K-O
6. Hamilton and Hardy

References for Specific Control Methods

Hygienic Guides and Sax were the references used for the Specific Control Methods in numbers 1 - 6.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 100 ppm.

WARNING PROPERTIES: Gas sorbent respiratory equipment is permitted.

The AIHA Hygienic Guides reports that 1,1-dichloroethane has a distinctive, easily recognizable odor at the TLV.

EYE IRRITATION: 1,1 - Dichloroethane is not known to be an eye irritant.

LFL: The lower flammable limit of 1,1 - dichloroethane is 59,000 ppm.

IDLH: 4000 ppm.

IDLH BASIS: Patty reports that rats survive 8-hour exposures to 4000 ppm but die at 16,000 ppm. The concentration of 16,000 ppm 1,1-dichloroethane has not been chosen as the IDLH, however, since Kirk-Othmer indicates that 1,1-dichloroethane causes narcosis. For the

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purposes of this standard, 4000 ppm is assumed to be the IDLH concentration.

SUMMARY OF TOXICOLOGY:

Exposures to 1,1 - dichloroethane can result in central nervous system depression and in liver injury. Patty reports that rats survive 8 - hour exposures to 4000 ppm, but die at 16,000 ppm. According to Browning, Lazarew determined the lethal dose to be 17,500 ppm for mice.

Relatively little has been published concerning the toxicity of 1,1 - dichloroethane. The Documentation of TLV's, however, states that available data indicate that the toxicity of 1,1 - dichloroethane is "no more than half that of carbon tetrachloride, chloroform, and ethylene dichloride." According to Kirk-Othmer, 1,1 - dichloroethane is less narcotic than chloroform. The AIHA Hygienic Guides state that concentrations of chloroform of 4100 ppm or less "may cause disorientation serious enough to result in falls or other mechanical accidents." Dizziness can be produced in humans by a single 5 to 10 - minute exposure to 1000 ppm chloroform.

VAPOR PRESSURE AT 20 C: 182 mm.

SATURATED AIR CONCENTRATION: 240,000 ppm.

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	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor and skin contact with liquid during use in dewaxing of mineral oils	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)
2.	Inhalation of vapor and skin contact with liquid during use as an extractant for heat sensitive substances	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)
3.	Inhalation of vapor and skin contact with liquid during use as a fumigant	A,B	General dilution ventilation of work area; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)
4.	Inhalation of vapor and skin contact with liquid during the manufacture of vinyl chloride by vapor phase cracking of 1,1-dichloroethane	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)
5.	Inhalation of vapor and skin contact with liquid during the preparation of rubber and silicone greases for high - vacuum apparatus	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)
6.	Inhalation of vapor and skin contact with liquid in the use as a chemical intermediate	A,B	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, respiratory protective devices, impervious gloves and clothing)

A -- Inhalation

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