NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND SUPPORTING DOCUMENTATION FOR

*** ETHYLENE DICHLORIDE ***

NIOSH/OSHA Draft Technical Standard and Supporting Documentation for ETHYLENE DICHLORIDE

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 ETHYLENE DICHLORIDE.

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.

(a) Definitions. (1) "Permissible exposure" means exposure of employees to airborne concentrations of ethylene dichloride not in excess of 50 parts per million (ppm) averaged over an eight-hour work shift (time weighted average) and not in excess of 100 parts per million (ppm) at any time during an eight-hour work shift except that an exposure not in excess of 200 parts per million (ppm) at any aggregate of 5 minutes in any 3 hours shall be permitted as stated in $ 1910.1000, Table Z-2.

(2) "Action level" means one half of the permissible exposure for ethylene dichloride for an eight-hour work shift.

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

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

(i) Any information, observations, or calculations which may indicate employee exposure to ethylene dichloride;

(ii) Any measurements of ethylene dichloride taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to ethylene dichloride; 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 ethylene dichloride 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 ethylene dichloride 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 ethylene dichloride 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 ethylene dichloride 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.

(iii) Individually notify, in writing, within five days, every employee who is found to be exposed to ethylene dichloride 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 ethylene dichloride 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 the time periods appropriate to the permissible exposure (See Appendix B (iv) of this section).

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

Table 1

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

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

(2) Employee exposures to airborne concentrations of ethylene dichloride 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 ethylene dichloride.

(ii) In the design of open surface tank ventilation for the purposes of § 1910.94(d), operations involving ethylene dichloride 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 ethylene dichloride 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 ETHYLENE DICHLORIDE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
1000 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 1000 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 ethylene dichloride.

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

(3) For the purpose of compliance with $ 1910.157, ethylene dichloride 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 ethylene dichloride shall be Class I, Group D.

(5) For the purpose of compliance with $ 1910.106, liquid ethylene dichloride is classified as a Class IB flammable liquid.

(6) Spray finishing operations shall be performed in accordance with $$ 1910.107 and 1910.94(c).

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

(8) Where a fan is located in ductwork and where ethylene dichloride is present in the ductwork in concentrations greater than 16,000 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.

(9) Sources of ignition such as smoking or open flames are prohibited where ethylene dichloride presents a fire or explosion hazard.

(10) Ethylene dichloride shall be stored so as not to come in contact with strong oxidizers, strong caustics, and chemically active metals.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid ethylene dichloride. Face shields shall comply with $ 1910.133(a)(2), (a)(4), (a)(5), (a)(6).

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

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

(4) Employers shall ensure that clothing which becomes wet with liquid ethylene dichloride be removed immediately and not reworn until the ethylene dichloride is removed from the clothing.

(5) 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 ethylene dichloride may contact the eyes.

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

(2) Liquid ethylene dichloride 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 contaminated with liquid ethylene dichloride promptly wash or shower with soap or mild detergent and water to remove any ethylene dichloride from the skin.

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

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for ethylene dichloride (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to ethylene dichloride.

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to ethylene dichloride which are listed in Appendix A of the section; and

(iv) Provide training to ensure that employees understand the precautions of safe use, emergency procedures, and the correct use of protective equipment relative to ethylene dichloride.

(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 make available to each employee who is to be exposed to liquid ethylene dichloride or airborne concentrations of ethylene dichloride at or above the action level, without regard to the use of respirators, a medical examination which shall include the following:

(i) A medical history and physical examination with emphasis on the kidneys and liver.

(ii) A profile of liver function.

(iii) Urinalysis to include specific gravity, albumin, glucose, and a microscopic on centrifuged sediment.

(3) The employer shall obtain from the physician, as a record of the examination, the following information:

(i) A written opinion which conforms with paragraph (j)(7) of this section.

(ii) A record of the results of the liver function tests.

(iii) A record of the results of urinalysis.

(4) The employer shall make available to each employee, exposed to ethylene dichloride in excess of the action level at 12 months from the

date of the employee's first exposure, and at every 12 months of exposure in excess of the action level thereafter, a medical examination which must include the following:

(i) A medical history and physical examination (see paragraph (j)(2)(i) of this section).

(ii) A profile of liver function.

(iii) Urinalysis (see paragraph (j)(2)(iii) of this section).

(5) The employer shall obtain from the physician, as a record of the periodic examination, the following information:

(i) A written opinion which conforms with paragraph (j)(7) of this section.

(ii) A record of the results of the liver function tests.

(iii) A record of the results of urinalysis.

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

(i) A copy of this regulation with its Appendixes A, B, and C for ethylene dichloride;

(ii) A description of the employee's duties as they relate to his exposure to ethylene dichloride;

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

(iv) The results of any measurement 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 examination of the affected employee.

(7)(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 ethylene dichloride or would directly or indirectly aggravate any detected medical condition.

(B) Any recommended limitations upon the employee's exposure to ethylene dichloride, 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 ethylene dichloride.

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

(8) No employee shall be exposed to liquid ethylene dichloride or airborne concencentrations of ethylene dichloride 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.

(9) The employer shall provide emergency and follow-up medical examinations and treatment for any employee injured through exposure to ethylene dichloride.

(10) If the examining physician chooses to use alternative medical examinations to those specified in paragraphs (j)(2) and (4) of this section, the employer may accept such alternative medical surveillance

examinations as meeting the requirements of this part provided that the employer:

(i) Obtains a statement from the examining physician setting forth the alternative medical examinations and the rationale for substitution and evidence that they will be equally effective.

(ii) Informs each exposed employee of the fact that alternative medical examinations to those required in paragraphs (j)(2) or (4) of this section are to be made available.

(11) 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 risks involved by refusing to be examined.

(12) 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 ethylene dichloride.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to ethylene dichloride which are being monitored;

(C) Sampling and analytical methods used and evidence of their accuracy, including the method, results and date of calibration of sampling equipment;

(D) Number, duration, and results of samples taken; and

(E) Name, social security number and exposure of the employee monitored.

(iii) This record shall be maintained until replaced by a more recent record but in no event for less than one year.

(3) Mechanical ventilation. (i) When mechanical ventilation is used as an engineering control, the employer shall maintain an accurate record of the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

(iii) These records shall be maintained for at least one year.

(4) Employee training and information. (i) The employer shall keep an accurate record of all employee training and information required by paragraph (i) of this section.

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;

(C) Content or scope of training provided.

(iii) This record shall be maintained until replaced by a more recent record.

(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.

(ii) The record shall include:

(A) Results of tests required by paragraph (j)(2) and (j)(5) of this section;

(B) Any employee medical complaints relative to exposure to ethylene dichloride;

(C) A copy of information provided to the physician pursuant to paragraph (j)(6)(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 ethylene dichloride which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to ethylene dichloride 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 ethylene dichloride that are being performed at the place of exposure; and

(iii) Record the results obtained.

NOTE: The information contained in the following appendixes is advisory in nature and is not intended, by itself, to create any additional obligations not otherwise imposed or detract from any existing obligation.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ETHYLENE DICHLORIDE

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR ETHYLENE DICHLORIDE

I. SUBSTANCE IDENTIFICATION

A. Substance: Ethylene dichloride

B. Permissible Exposure: 50 parts of ethylene dichloride per million parts of air (ppm), averaged over an eight-hour work shift. Also, 100 ppm shall not be exceeded in an eight-hour work shift except that a peak of 200 ppm is permitted for 5 minutes in any 3 hours during the work shift.

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

II. HEALTH HAZARD DATA

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

B. Effects of Overexposure:

1. Short-Term Exposure: Overexposure to ethylene dichloride may cause drowsiness, dizziness, nausea and vomiting. High vapor concentrations can irritate the eyes, nose and throat. The liquid splashed in the eyes may cause irritation.

2. Long-Term Exposure: Prolonged and repeated exposure to ethylene dichloride vapor may cause liver and kidney damage. Prolonged or repeated skin exposure to the liquid may cause skin irritation.

3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they are caused by exposure to ethylene dichloride.

III. EMERGENCY FIRST AID PROCEDURES

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

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

C. Breathing: If you or any other person breathes in large amounts of ethylene dichloride 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 ethylene dichloride 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 ethylene dichloride. 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 ethylene dichloride 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 ethylene dichloride. Replace or repair impervious protective clothing that has developed leaks.

C. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid ethylene dichloride may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. Ethylene dichloride is a flammable liquid and its vapors easily form explosive mixtures with air.

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

C. Sources of ignition such as smoking and open flames are prohibited wherever ethylene dichloride 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 ethylene dichloride, and containers must be bonded and grounded when pouring or transferring liquid ethylene dichloride.

E. If your skin becomes contaminated with liquid ethylene dichloride, you must promptly wash or shower with soap or mild detergent and water to remove any ethylene dichloride from the skin.

F. You must promptly remove any non-impervious clothing that becomes contaminated with liquid ethylene dichloride and this clothing must not be reworn until the ethylene dichloride is removed from the clothing.

G. Clothing wet with ethylene dichloride can easily be ignited. You must immediately remove this clothing and it must not be reworn until the ethylene dichloride is removed from the clothing.

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

I. Ask your supervisor where ethylene dichloride 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 ethylene dichloride. In addition, your employer must instruct you in the safe use of ethylene dichloride, emergency procedures, and the correct use of protective equipment.

B. Your employer is required to determine whether you are being exposed to ethylene dichloride. 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 ETHYLENE DICHLORIDE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Ethylene chloride; 1,2-dichloroethane; glycol dichloride
2. Formula: ClCH2CH2Cl
3. Molecular weight: 98.96

B. Physical Data

1. Boiling point (760 mm Hg): 83.5 C (183 F)
2. Specific gravity (water = 1): 1.25
3. Vapor density (air = 1 at boiling point of ethylene dichloride): 3.4
4. Melting point: -35.5 C (-32 F)
5. Vapor pressure at 20 C (68 F): 62 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): 0.81
7. Evaporation rate (butyl acetate = 1): 6.46
8. Appearance and odor: Clear liquid with a sweet odor, like chloroform

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 13 C (55 F) (closed cup)
2. Autoignition temperature: 413 C (775 F)
3. Flammable limits in air, % by volume: Lower: 6.2; Upper: 16
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: Ethylene dichloride is a flammable liquid. Its vapors can easily form explosive mixtures with air. All ignition sources must be controlled where ethylene dichloride is handled, used or stored in a manner that could create a potential fire or explosion hazard. Ethylene dichloride 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 ethylene dichloride is handled.
7. For purposes of conforming with the requirements of 29 CFR 1910.106, ethylene dichloride is classified as a Class IB flammable liquid. Above 16,000 ppm, approximately one-fourth of the lower flammable limit, is one situation in which ethylene dichloride 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 ethylene dichloride shall be Class I Group D.

B. Reactivity

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

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

A. If ethylene dichloride 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. Ethylene dichloride 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: Ethylene dichloride 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:

1. Eight hour exposure evaluation: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average eight-hour exposure may be determined from a single sample or two (2) four-hour samples. Short term samples (up to 30 minutes) may also be used to determine average exposure level if a minimum of five (5) measurements are taken in a random manner over the eight-hour work shift. Random sampling means that any portion of the work shift has the same chance of being sampled as any other. The arithmetic average of all such random equal duration samples taken on one (1) work shift is an estimate of an employee's average level of exposure for that work shift. Air samples should be taken in the employee's

breathing zone (air that would most nearly represent that inhaled by the employee).

2. Ceiling Evaluation: Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentrations of ethylene dichloride in the employee's breathing zone. A minimum of three measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

3. Peak Above Ceiling Evaluation: Measurements taken for the purpose of determining employee exposure under this section must be taken during periods of maximum expected airborne concentration of ethylene dichloride. Each measurement should consist of a 5-minute sample or series of consecutive samples totaling five (5) minutes in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). A minimum of three measurements should be taken on one work shift and the highest of all measurements taken is an estimate of the employee's exposure.

4. Monitoring Techniques: The sampling and analyses under this section 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 ethylene dichloride 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). When sampling for peak exposure evaluations, more than three (3) measurements should be taken during the work shift so that increased confidence may be placed in the judgement that the employee has or has not, in fact, been exposed in excess of the permissible limit. 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 ethylene dichloride 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 ethylene dichloride in tightly closed containers in a cool, well ventilated area.

B. High exposures to ethylene dichloride can occur when transferring the liquid from one container to another.

C. Non-sparking tools must be used to open and close metal ethylene dichloride 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 ethylene dichloride could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to ethylene dichloride is likely to occur are: during its production and its use as an industrial solvent; during use in the manufacture of vinyl chloride, ethyleneamines, succinic acid, chlorinated solvents, as an additive to gasoline; and as a fumigant.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; ingestion.

II. TOXICOLOGY

Ethylene dichloride vapor is a narcotic and causes injury to the liver and kidneys. Rats did not survive when exposed to 20,000 ppm for longer than 12 minutes or to 300 ppm for longer than 7 hours; 3000 ppm produced stupor, biochemical impairment of liver function and histopathologic changes in the liver, kidneys and adrenals. Repeated exposures at 200 ppm resulted in some deaths, with evidence of pulmonary congestion. A number of human fatalities from industrial exposure have been recorded, primarily from impairment of liver and kidney function, occasionally with pulmonary edema. The predominant symptoms were mental confusion, dizziness, nausea, and vomiting. The ingestion of this substance obtained from industrial supplies has also resulted in fatalities. Eye contact with either the liquid or with high concentrations of vapor causes immediate discomfort in all species with conjunctival hyperemia and slight corneal injury; human corneal burns from splashes recover quickly. Prolonged skin exposure, as from contact with soaked clothing, produces severe irritation, moderate edema, and necrosis. Repeated skin contact may cause rough, red, dry skin due to solvent action. Corneal opacities may occur from systemic absorption.

III. SIGNS AND SYMPTOMS

Signs of central nervous system depression; nausea and vomiting; dermatitis; eye irritation, possible corneal opacity.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of ethylene dichloride are caused by its capacity to affect the liver and kidneys. Alcohol intake may potentiate the effects. It is important that the physician become familiar with plant operating conditions in

which exposure to ethylene dichloride 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 repirators.

B. PREPLACEMENT

The following medical procedures must be made available to each employee who is exposed to ethylene dichloride.

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitory. Examination of kidneys, liver and eyes should be stressed. The skin should be examined for evidence of chronic disorders.

2. Liver function tests -- Ethylene dichloride may cause liver damage. A profile of liver function shall be obtained by using a medically acceptable array of biochemical tests.

3. Urinalysis -- Since kidney damage has been observed from exposure, a urinalysis shall be obtained to include at a minimum specific gravity, albumin, glucose, and microscopic on centrifuged sediment.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis.

References

1. American Conference of Governmental Industrial Hygienists: "1, 2-Dichloroethane (Ethylene Dichloride)," Documentation of the Treshold Limit Values for Substances in WorkRoom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 79-80.

2. Hygienic Guide Series: "1,2-Dichloroethane," American Industrial Hygiene Association Journal, 26:435-438, 1965.

3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1280-1284.

4. Browning, Ethel: Toxicity and Metabolism of Industrial Solvents, Elsevier Publishing Company, Amsterdam, 1965, pp. 247-252.

REFERENCES AND SOURCES
ETHYLENE DICHLORIDE
1910.93

(d) Compliance - Open surface tank classification based on relative evaporation rate of 1.2 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 Science, 1973, report to U. S. Coast Guard, report no. CG-D-92-74, p. 14.

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

Eye: Grant, "Toxicology of the Eye;" Elkins, "Toxicology of Industrial Solvents"

Skin: Patty, "Industrial Hygiene and Toxicology;" "Ethylene Dichloride," Chemical Data Sheet, Dow Chemical Co.

Ingestion: Browning, "Toxicity and Metabolism of Industrial Solvents;" Patty, "Industrial Hygiene and Toxicology;" NIOSH Toxic Substances List (1973); Spector, "Handbook of Toxicology;" Hunter, "The Diseases of Occupation"

COMMENTS

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

Elkins states that contact "causes cloudiness and deformation of the cornea of the eye in animals," but similar results have not been found in humans. Grant reports one drop of liquid caused "immediate discomfort in all species and hyperemia of the conjunctiva and slight corneal epithelial disturbance, but the eyes returned to normal in one or two days."

Skin - Classification: 2
Output statement numbers: 2, 7b, 8, 14g, 14i, 21
Exceptions: see below

Patty states ordinary contact causes "no serious difficulties" but prolonged or repeated contact results in "quite serious irritation, moderate edema and necrosis." He continues, "dichloroethylene is absorbed through the skin and requires a dose of around 2 g/kg body weight held in contact with a large area of the body for a period of 24 hours in order to cause death in rabbits." Owing to the dissolution of skin oils, the skin cracks easily and is readily susceptable to infection. The vapor pressure of the substance is 62 mm Hg at 20 C. Its flashpoint is about 55 F. The substance is given a classification of 2 and statements 17 are used instead of those numbered 16 due to the effects ethylene dichloride has on the skin. Statement 20a is not specified because of the significant vapor pressure of the substance.

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

Spector reports an oral rat LD50 of 770 mg/kg. Patty gives an oral rat LD50 of 0.68 g/kg as does NIOSH. Browning states that ingestion results in "irritation of the gastro-intestinal tract, vomiting, diarrhea, fainting" and death from respiratory and circulatory failure. Gleason reports an oral intake of 30 to 70 gm as fatal for humans; the ILO gives values of 20 to 60 gm. Because ethylene dichloride is readily absorbed by the gastrointestinal tract, fatty degeneration of the liver and kidney damage are also reported. Because of its vapor pressure of 62 mm Hg at 20 C, it is concluded that ingestion of harmful amounts would not be a problem in industry.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)
Manufacturing Chemists Association, Chemical Safety Data Sheet SD-18 (MCA)
Union Carbide Corp., Material Safety Data Sheet (UCC)
Dow Chemical USA, Material Safety Data Sheet (Dow)
Olin Chemicals Product Data, "Ethylene Dichloride (Olin)

Sources of data items used:

I. A. 1. Synonyms: NFPA-325M; MCA; UCC
2. Formula: NFPA-49
3. Molecular weight: UCC
B. 1. Boiling point: NFPA-325M; UCC
2. Specific gravity: UCC
3. Vapor density: NFPA-325M; MCA; UCC
4. Melting point: MCA; UCC
5. Vapor pressure: MCA; UCC
6. Solubility in water: MCA; UCC
7. Evaporation rate: UCC
8. Appearance and odor: NFPA-49; MCA

II. A. 1. Flash point: MCA
2. Autoignition temperature: NFPA-325M; MCA; UCC
3. Flammable limits: NFPA-325M; MCA; UCC
4. Extinguishing media: NFPA-49
5. Special fire fighting procedures: NFPA-49
6. Unusual fire and explosion hazards: Dow
B. 1. Conditions contributing to instability: ADL
2. Incompatibilities: NFPA-49; Dow; UCC
3. Hazardous decomposition products: UCC
4. Special precautions: ADL

III. A. Steps if released or spilled: MCA; ADL
C. Waste disposal method: MCA; UCC
V. Miscellaneous precautions: MCA; ADL
VI. Common operations: Olin

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

"Ethylene Dichloride," Chemical Safety Data Sheet SD-18, Manufacturing Chemists Association, 1971 (CSDS)

"Chemical Origins and Markets - Flow Charts and Tables," 4th edition, Stanford Research Institute, 1967 (Chemical Origins)
Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill, 1974 (Considine)
"Ethylene Dichloride," Hazard Process Index, Hazard Entry No. 78, NIOSH HSM-99-73-62 (HPI)
"Ethylene Dichloride," Product Data, Olin Corporation, Chemicals Division (Olin)
"1,2-Ethylene Dichloride," Material Safety Data Sheet, Union Carbide (MSDS)
Gleason, M. N. et al., "Chemical Toxicology of Commercial Products," Williams and Wilkins Co., 1969 (Gleason)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, 1954 (Chem Tech)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," 2nd edition, Interscience Publishers, 1972 (K-O)
Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)

References for Specific Use/Exposure

1. Considine, SRI
2. HPI, SRI
3. K-O, SRI
4. HPI, Olin, SRI
5. HPI, Olin, SRI
6. Chem Tech, Gleason, HPI, Olin
7. Chemical Origins, Considine, SRI
8. K-O, SRI
9. ADL estimate, CSDS
10. Chem Tech

References for Specific Control Methods

HPI and MSDS were the references used in numbers 1 - 4.

5. MSDS
6. ADL estimate, MSDS
7. HPI, MSDS
8. HPI, MSDS
9. ADL estimate, MSDS
10. HPI, MSDS

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RESPIRATOR TABLE DOCUMENTATION

Substance: Ethylene dichloride

D. O. L. Standard: 50 ppm, where 100 ppm shall not be exceeded except that a peak is permitted of 200 ppm for 5 minutes in any 3 hours.

WARNING PROPERTIES:

Odor Threshold: Patty states that a person can become adapted to the odor of 1,2-dichloroethane at low concentrations. The odor is perceptible at 50 ppm, definite at 100 ppm, and pronounced at 200 ppm. Patty states that "even though the odor may be definite enough to act as a warning of acutely hazardous concentrations, it is probably not sufficiently striking to be considered a significant warning of hazardous chronic exposure," especially since adaptation occurs at low concentrations.

Eye Irritation Level: Grant reports that "experimental exposure of the eyes to a high concentration of the vapor . . . is known, however, to cause immediate discomfort in all species, and hyperemia of the conjunctiva and slight corneal epithelial disturbance may result, but the eyes return to normal within a day or two." The exact concentrations producing eye irritation are not mentioned.

Other Information: Patty reports that ethylene dichloride is irritating to the nose and throat as well as to the eyes, but the concentrations producing this irritation are not given.

Evaluation of Warning Properties: Since a person can become adapted to the odor of ethylene dichloride at low concentrations, and since no quantitative data are available relating the irritant effects of ethylene dichloride to air concentrations, this material is considered to have poor warning properties. Gas sorbent respiratory equipment is not permitted.

IDLH: 1000 ppm

Basis for IDLH Value: Patty reports a "maximum time-concentration in air" which was survived by female rats for 1.5 hours of 1000 ppm. Based upon this information, the IDLH concentration of 1000 ppm 1,2-dichloroethane is assumed for the purposes of this standard. Further support of this IDLH is the 4-hour rat LCL0 of 1000 ppm noted in the NIOSH Toxic Substances List.

Other Toxicological Information: Patty reports that exposure to high concentrations of 1,2-dichloroethane causes irritation of the eyes, nose, and throat. The chief symptoms of ethylene dichloride exposure are CNS depression and gastrointestinal disturbances.

In addition, Browning states that corneal opacity can result from inhalation of the vapor. Patty notes one investigation of the response of rats to exposures to vapor concentrations of ethylene dichloride. "The maximum time-concentrations in air survived by rats from a single exposure were as follows:" 20,000 ppm for 12 minutes, 3000 ppm for 1 hour, and 300 ppm for 7 hours. These maximum time-concentrations for female rats were: 12,000 ppm for 6 minutes, 1000 ppm for 1.5 hours, and 200 ppm for 7 hours. According to Patty, animal exposure experiments with other species support this data. Exposures to concentrations of 3000 ppm or more produced inactivity or stupor.

Spector reports a rat LC50 of 4 mg/l (approximately 1000 ppm)

for ethylene dichloride, and guinea pig and rabbit LC100's of 12.4 mg/l (approximately 3060 ppm).

The NIOSH Toxic Substances List gives LCL0 concentration of 1000 ppm for the rat. The LCL0 is "the lowest concentration of a substance, other than an LC50, in air which has been reported to have caused death in man or to have caused death in animals when they have been exposed for 24 hours or less." In this investigation the period of exposure was 4 hours.

The AIHA Hygienic Guides note that 6-minute exposures of rats to 12,000 ppm and 18-minute exposures of rats to 3,000 ppm produced no adverse effects. Doubling the exposure times, however, caused "stupor, coma and cyanosis." No IDLH concentration is given by the Hygienic Guides, but it is reported in the Hygienic Guides that 18-minute exposures to rats to 20,000 ppm proved to be fatal.

The AIHA Hygienic Guides report that several poisonings have been reported from acute occupational exposures to ethylene dichloride but no concentrations are mentioned. Browning, in reporting several fatal causes from industrial exposures, states that autopsies of the victims revealed liver and kidney damage as well as pulmonary edema. No quantitative data are given.

LFL: 62,000 ppm

VAPOR PRESSURE: 62 mm Hg at 20 deg. C.
82 mm Hg at 25 deg. C.

SATURATED CONCENTRATION AT: 20 deg. C.: Approximately 81,600 ppm
25 deg. C.: Approximately 107,900 ppm

USE/EXPOSURE AND CONTROL DOCUMENT
ETHYLENE DICHLORIDE (1,2-DICHLOROETHANE)

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor during use as a chemical intermediate in the manufacture of vinyl chloride (starting monomer for a wide variety of plastic polymers and copolymers)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
2.	Inhalation of vapor during use as an intermediate in production of chlorinated solvents (trichloroethylene, tetrachloroethylene, methyl chloroform)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
3.	Inhalation of vapor during production of gasoline using tetraethyl lead as an anti-knock agent and ethylene dichloride as a lead scavenger (lead, which might remain in the engine is converted to lead chloride - a gas at temperatures prevailing inside an engine)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
4.	Inhalation of vapor during the production of ethylenamines (produced by reacting ammonia and ethylene dichloride)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
5.	Inhalation of vapor and skin contact with liquid during use as an industrial solvent (extractant solvent - nicotine, vitamins, cottonseed oil; general solvent - component of paint and varnish removers, textile cleaning of tars, rubber based adhesives, metal degreasing, soap scouring compounds)	A,B,D	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, goggles)
6.	Inhalation of vapor and	A,B,D	Local exhaust ventilation;

	skin contact with liquid during use as a grain, soil and household fumigant (control of insects, bacteria and fungi - rugs, upholstery, flour mill machinery, seeds, plants, mushroom houses, barley, corn, oats, rice, rye and wheat)		general dilution ventilation; personal protective equipment (goggles, gloves, protective clothing, respiratory protective devices)
7.	Inhalation of vapor during use as a chemical intermediate (vinylidine chloride, piperazine, thiokol rubbers, polysulfide elastomers, ethylene glycol diacetate)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
8.	Inhalation of vapor during manufacture of ethylene dichloride (chlorination or oxychlorination of ethylene). Generally produced captively at site of use as a stage of an integrated system.	A	Process enclosure; local exhaust ventilation; general dilution ventilation
9.	Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage vessels and during clean up of accidental spills	A,B,D	Local exhaust ventilation general dilution ventilation; personal protective equipment (goggles, gloves, protective clothing, respiratory protective devices)
10.	Inhalation of vapor during use in axeotropic distillation (dehydration of acetic acid)	A	Process enclosure; local exhaust ventilation; general dilution ventilation

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