NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND

SUPPORTING DOCUMENTATION FOR

*** DICHLORODIFLUOROMETHANE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DICHLORODIFLUOROMETHANE

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 DICHLORODIFLUOROMETHANE.

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 dichlorodifluoromethane in concentrations not in excess of 1,000 parts per million (ppm) (4,950 milligrams per cubic meter, mg/cu.m.) averaged over an eight-hour work shift, as stated in $$ 1910.93, Table G-1.

(2) "Action level" means one half of the permissible exposure for dichlorodifluoromethane.

(b) Exposure determination and measurement.

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

(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 dichlorodifluoromethane;

(ii) Any measurements of dichlorodifluoromethane taken;

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

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

(c) Methods of measurement.

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

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

Table 1

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

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

(2) Employee exposures to airborne concentrations of dichlorodifluoromethane 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. 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 dichlorodifluoromethane.

(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 dichlorodifluoromethane 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 DICHLORODIFLUOROMETHANE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Gas Concentration	
10,000 ppm or less	Any supplied-air respirator.
	Any self-contained breathing apparatus.
50,000 ppm or less	Any supplied-air respirator with a a full facepiece, helmet or hood.
	Any self-contained breathing apparatus with a full facepiece.
	A Type C supplied air respirator with a half facepiece operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 50,000 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepience 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 dichlorodifluoromethane.

(2) Dichlorodifluoromethane shall be stored so as not to come in contact with chemically active metals.

(f) Personal protective equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent the skin from becoming wet with liquid dichlorodifluoromethane or from becoming frozen from contact with vessels containing dichlorodifluoromethane. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that clothing which becomes wet with liquid dichlorodifluoromethane be removed immediately and not reworn until the dichlorodifluoromethane has evaporated.

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

(g) Spills and disposal. In the event that dichlorodifluoromethane is accidentally released, the employer shall provide available ventilation to disperse the gas.

(h) Reserved.

(i) Training and information. (1) Each employer who has a workplace in which dichlorodifluoromethane is present shall keep a copy of this regulation with Appendices A, B and C at the workplace. This material shall be made readily available to affected employees.

(2) Each employer who has employees exposed to dichlorodifluoromethane above the action level or employees who may have skin or eye contact with liquid dichlorodifluoromethane, or employees who work where accidental release of dichlorodifluoromethane may occur, shall annually:

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

(ii) Advise affected employees as to the signs and symptoms of exposure to dichlorodifluoromethane;

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to dichlorodifluoromethane which are listed in Appendix A of this 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 dichlorodifluoromethane.

(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 airborne concentrations of dichlorodifluoromethane 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) Heart disease

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

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

(ii) The employee informs the employer of the development of any of the medical conditions listed in paragraph (j)(2) of this section or any of the signs or symptoms of exposure to dichlorodifluoromethane which are listed in Appendix A which the employee suspects are caused by exposure to dichlorodifluoromethane.

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

(i) A copy of this regulation with Appendices A, B and C for dichlorodifluoromethane;

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

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

(iv) The results of any measurements which may indicate the affected employee's exposure;

(v) The affected employee's anticipated exposure level; and

(vi) Upon request of the physician, any available information from previous medical examinations of the affected employee.

(5) Where a medical examination is required by paragraph (j)(3) of this section, following such examination the employer shall obtain a written opinion from the examining physician which conforms with paragraph (j)(6) of this section.

(6)(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating: (A) Whether the employee has any detected medical condition which would place the employee at increased risk of material impairment of the employee's health from exposure to dichlorodifluoromethane or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to dichlorodifluoromethane including limitations upon the use of protective equipment and respirators;

(C) That the employee has been informed by the physician of any detected medical conditions which require further medical examination or treatment.

(ii) The physician's written opinion shall not reveal specific medical findings or diagnoses unrelated to exposure to dichlorodifluoromethane.

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

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

(8) The employer shall provide emergency medical treatment for any employee injured through exposure to dichlorodifluoromethane.

(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 dichlorodifluoromethane.

(ii) This record shall include:

(A) The date of measurement;

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

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

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

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

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

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

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

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

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

(ii) This record shall include:

(A) Date of training;

(B) Name and social security number of employee trained;
(C) Content or scope of training provided.
(iii) This record shall be maintained until replaced by a more recent record.
(5) Medical surveillance. (i) The employer shall keep an accurate record of employee medical surveillance required by paragraph (j) of this section.
(ii) This record shall include:
(A) Information concerning medical conditions obtained from the employee pursuant to paragraph (j)(2) of this section;
(B) Any employee medical complaints relative to exposure to dichlorodifluoromethane;
(C) A copy of information provided to the physician pursuant to paragraph (j)(4)(ii), (iii), (iv), (v), and (vi) of this section.
(D) Physician's written opinion; and
(E) A signed statement of any refusal to be examined.
(iii) This record shall be maintained for the duration of the employment of the affected employee.
(6) Access to records. (i) All records required to be maintained by this section shall be made available upon request to authorized representatives of the Assistant Secretary of Labor for Occupational Safety and Health and the Director of the National Institute for Occupational Safety and Health.
(ii) Employee exposure determination and exposure measurement records required to be maintained by this section shall be made available to employees and former employees and their designated representatives.
(iii) Employee medical records required to be maintained by this section shall be made available upon written request to a physician designated by the employee or former employee.
(l) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to dichlorodifluoromethane which is conducted pursuant to this section.
(2) When observation of measurement of employee exposure to dichlorodifluoromethane 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 dichlorodifluoromethane 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 DICHLORODIFLUOROMETHANE

I. SUBSTANCE IDENTIFICATION

A. Substance: Dichlorodifluoromethane

B. Permissible Exposure: 1000 parts of dichlorodifluoromethane per million parts of air (ppm) or 4950 milligrams of dichlorodifluoromethane per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.

C. Appearance and Odor: Colorless gas with a characteristic ether-like odor that is detectable only in concentrations well above the permissible exposure.

II. HEALTH HAZARD DATA

A. Ways in Which the Chemical Affects Your Body:
Dichlorodifluoromethane can affect your body if you inhale it or if it comes in contact with your eyes or skin.

B. Effects of Overexposure:

1. Exposure to dichlorodifluoromethane may cause dizziness, involuntary trembling, unconsciousness, and death. It may also cause irregular heart beat. If the liquid gets on your skin or in your eyes, it may cause frostbite.
2. Long-Term Exposure: None known
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 dichlorodifluoromethane.

III. EMERGENCY FIRST AID PROCEDURES

A. Eye Exposure: If liquid dichlorodifluoromethane gets into your eyes, wash your eyes immediately with large amounts of water, lifting the upper and lower lids occasionally. Get medical attention immediately. Contact lens should not be worn when working with this chemical.

B. Skin Irritation: If liquid dichlorodifluoromethane gets on your skin, immediately flush the skin with water if the dichlorodifluoromethane has not already evaporated. If liquid dichlorodifluoromethane soaks through your clothing, remove the clothing immediately and flush the skin with water. Do not use hot water for skin flushing. If irritation is present after washing, get medical attention.

C. Breathing: If you or any other person breathes in large amounts of dichlorodifluoromethane, 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. 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 dichlorodifluoromethane. 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 dichlorodifluoromethane 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 your skin from becoming wetted with liquid dichlorodifluoromethane or from becoming frozen from contact with vessels containing dichlorodifluoromethane. 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 dichlorodifluoromethane may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

A. Dichlorodifluoromethane must be stored in a cool, well-ventilated area away from chemically active metals.

B. Dichlorodifluoromethane vapors may accumulate in low places and result in suffocating atmospheres.

C. You must immediately remove any clothing that becomes wet with liquid dichlorodifluoromethane and this clothing must not be reworn until the dichlorodifluoromethane has evaporated from the clothing.

D. Ask your supervisor where dichlorodifluoromethane 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 dichlorodifluoromethane and to instruct you in the safe and correct use of protective equipment.

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

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

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES FOR DICHLORODIFLUOROMETHANE

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Refrigerant 12; Freon 12; propellant 12; Halon 122
2. Formula: CCl_2F_2
3. Molecular weight: 120.9

B. Physical Data

1. Boiling point (760 mm Hg): -29.8 C (-21.6 F)
2. Specific gravity (Water = 1): 1.49 (at boiling point)
3. Vapor density (air = 1 at boiling point of dichlorodifluoromethane): 4.2
4. Melting point: -157.7 C (-252 F)
5. Vapor pressure at 20 C (68 F): 5.7 atm.
6. Solubility in water, % by weight at 20 C (68 F): 0.008
7. Evaporation rate (butyl acetate = 1): 380
8. Appearance and odor: Colorless gas with a characteristic ether-like odor when present above 20% by volume

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Not combustible

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Reacts with chemically active metals such as sodium, potassium, calcium, powdered aluminum, zinc and magnesium.
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen chloride, phosgene, and hydrogen fluoride) may be released when dichlorodifluoromethane decomposes.
4. Special precautions: Liquid dichlorodifluoromethane will attack some forms of plastics, rubber and coatings.

III. SPILL AND LEAK PROCEDURES

A. If dichlorodifluoromethane is leaked, the following steps should be taken:

1. Ventilate area of spill or leak

2. Stop flow of gas

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

IV. MONITORING AND MEASUREMENT PROCEDURES

A. Exposure Above the Action Level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Several short term interval samples (up to 30 minutes) may also be used to determine average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR Part 84, portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of dichlorodifluoromethane to plus or minus 35%.

B. Exposure Above the Permissible Exposure: The monitoring under this section should be essentially the same as described under paragraph (IV)(A). Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association (AIHA). The method of measurement must determine the concentration of dichlorodifluoromethane to plus or minus 25%.

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

D. Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

A. Store dichlorodifluoromethane in a well-ventilated area.

B. Dichlorodifluoromethane vapors may accumulate in low places and result in suffocating atmospheres.

C. Employers should advise employees of all areas and operations where exposure to dichlorodifluoromethane could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to dichlorodifluoromethane is likely to occur are: during its use as a refrigerant in domestic, automotive and industrial air conditioning systems; as an aerosol propellant; as a blowing agent for cellular polymers; as a foaming agent; and as a solvent or diluent; during the manufacture of materials for electrical applications; during the synthesis of other freons; and during its production.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Dichlorodifluoromethane vapor is a narcotic and can cause asphyxia at very high concentrations. At 800,000 ppm rats were deeply anesthetized, but 4 to 6 hours exposure produced no permanent effects. At 200,000 ppm dogs and monkeys showed only tremors, salivation, and lacrimation. Inhalation by man at 150,000 ppm produces unconsciousness, while dizziness occurs at 50,000 ppm. Sniffing aerosols of fluorochlorinated hydrocarbons has caused sudden death due to cardiac arrest probably due to sensitization of the myocardium. In liquid form this substance may cause frostbite.

III. SIGNS AND SYMPTOMS

At very high concentrations, dizziness, tremors, unconsciousness; may cause cardiac arrhythmias and cardiac arrest.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Give artificial resuscitation if indicated. Recovery is usually rapid and complete. Caution should be exercised in using epinephrines or similar drugs.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Dichlorodifluoromethane at high levels may cause narcosis. It is possible that extremely high concentrations may cause cardiac arrhythmias and death. It is important that the physician becomes familiar with plant operating conditions in which exposure to dichlorodifluoromethane occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

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

1. Cardiovascular disease -- In persons with impaired cardiovascular function, especially those with a history of

cardiac arrhythmias, the inhalation of dichlorodifluoromethane might cause exacerbation of disorders of the conduction mechanism due to its sensitizing effects on the myocardium.

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: "Dichlorodifluoromethane," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 78.

2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1324-1325.

3. International Labour Office: Encyclopaedia of Occupational Health and Safety, Vol. I, A-K, New York, McGraw Hill Book Company, 1974, pp. 560-561.

4. Hygienic Guide Series: "Dichlorodifluoromethane," American Industrial Hygiene Association Journal, 29:513-516, 1968.

5. Reinhardt, Charles F., et al: "Cardiac Arrhythmias and Aerosol 'Sniffing'," Archives of Environmental Health, 22:265-279, 1971.

REFERENCES AND SOURCES
DICHLORODIFLUOROMETHANE
1910.93

(e) Fire and safety: Open surface tank classification based on boiling point of -22 F and guidelines found in Ansi 29.1-1971. "Practices for Ventilation and Operation of Open Surface Tanks," P. 19.

(g) Personal Protecthve Equipment, and, (h) Sanitation

Eye: duPont, "Freon Compounds and Safety," Freon Product Information; Grant, "Toxicology of the Eye"

Skin: Gleason, "Clinical Toxicology of Commercial Products;" Stecher, "The Merck Index - An Encyclopedia of Chemicals and Drugs;" Sax, "Dangerous Properties of Industrial Materials;" duPont, "Freon Compounds and Safety," Freon Product Information

Ingestion: Gleason, "Clinical Toxicology of Commercial Products;" Stecher, "The Merck Index - An Encyclopedia of Chemicals and Drugs;" American Industrial Hygiene Association, "Hygienic Guides Series - Dichlorodifluoromethane"

COMMENTS

Eye - Classification: 2
Output statements for low boiling liquids used.
Exceptions: None
DuPont states "if lower boiling liquids contact the eye serious damage from freezing may occur." Grant reports experiments showing "a blast of a mixture of liquid F-12 (this substance) and lubricating oil from a refrigerator applied directly to rabbit eyes for a second or two with the lids held open caused momentary freezing . . . followed by slight epithelial edema and partial loss of epithelium, but complete recovery in 3 days." Experiments showing residual effects six weeks after exposure of rabbit eyes to pure liquefied Freon 12 for 5 to 10 seconds are also reported. Grant concludes that "the speed of reflex closure of the eyes is such that it seems extremely unlikely that any serious injury would result from an accidental spray of the substance in the eyes of human beings."

Skin - Classification: 2
Output statements for low boiling liquids used.
Exceptions: None
Gleason states that the substance is "nontoxic" by this route of entry. Merck Index classifies it as "nonirritating;" however, the fact that its boiling point is listed as -21.6 F suggests the possibility of freeze burns following splashes. DuPont states "if the liquid phases of the lower-boiling "Freon" products comes in contact with the skin the rapid evaporation may cause freezing." The substance is not combustible.
In the rare instances it would be present in the workplace in uncontained liquid form, body contact

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

Gleason states that the substance is "nontoxic" by this route of entry. Due to the low boiling point (-21.6 F) listed in the Merck Index, the probability of toxic effects through ingestion seems remote. "Rats on a dosage of 430 mg/kg body weight in peanut oil daily for 10 days showed no clinical signs of toxicity or histological change," according to the Hygienic Guide.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

Union Carbide Corp., Material Safety Data Sheet (UCC)
Kaiser Aluminum and Chemical Corp., Material Safety Data Sheet (Kaiser)
E. I. duPont de Nemours and Co., "Freon Compounds and Safety" (duP)
"Matheson Gas Data Book," 5th edition, p. 185 (Math)
Union Carbide Corp., Linde Division, "Linde Specialty Gases - Safety Precautions and Emergency Procedures" (Linde)

Sources of data items used:

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

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

"Chemical Abstracts," 66 - 75 (1967 - 71); 78 (1973) (CA)
"Chem Eng.," 4/15/74, p. 86 (Chem Eng)
Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw - Hill, 1974 (Considine)
"Dichlorodifluoromethane," American Conference of Government Industrial Hygienists, Hygienic Guide Series, Sept - Oct. 1968 (Guide)
"Dichlorodifluoromethane," Dow Chemical Co., Material Safety Data Sheet (Dow)
"Dichlorodifluoromethane," E. I. duPont de Nemours and Co., Freon Product Information B-2, 1969 (duPont B-2)
"Dichlorodifluoromethane," E. I. duPont de Nemours and Co., "Freon Compounds and Safety," S-16, 1969 (duPont Safety)
"Dichlorodifluoromethane," Hazard Process Index, Hazard Entry No. 85a, NIOSH-HSM-99-73-62 (HPI)
"Dichlorodifluoromethane," Kaiser Chemicals, Material Safety Data Sheet (Kaiser)
"Dichlorodifluoromethane," Pennwalt Corp., Material Safety Data Sheet

(Pennwalt)
"Dichlorodifluoromethane," Union Carbide Corp., Material Safety Data Sheet (Carbide)
Faith, W. L., Keyes, D. P. and Clark, R. L., "Industrial Chemicals," John Wiley, Inc., 1965 (Faith)
International Labour Organization, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 1st edition, 1954 (Chem Tech)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 2nd edition, 1972 (K-O)
Mellan, I., "Handbook of Solvents," Vol. II, Reinhold, 1957 (Mellan)
Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience, 1962 (Patty)
Simons, J. H., "Fluorine Chemistry," Vol. 5, Academic Press, 1964 (Simons)
Stanford Research Institute, "Chemical Economics Handbook," Menlo Park, California (SRI)
Von Oettingen, W. F., "The Halogenated Hydrocarbons of Industrial and Toxicological Importance," Elsevier, 1964 (von Oettingen)

Reference for Specific Use/Exposure

1. CA, Chem Eng, duPont B-2, Faith, Guide, HPI, ILO, K-O, Mellan, Simons, Patty, Von Oettingen
2. CA, Chem Eng, duPont B-2, Faith, Guide, HPI, ILO, K-O, Mellan, Simons, Patty, Pennwalt, Von Oettingen
3. CA, Chem Eng. K-O, ILO
4. CA, Carbide, Guide, Mellan
5. CA, ILO
6. CA, Chem Eng, Simons, SRI
7. CA, Considine, duPont B-2, Pennwalt
8. CA
9. CA, Carbide, duPont
10. CA, Chem Tech
11. CA, K-O
12. CA

References for Specific Control Methods

Carbide, Dow, duPont Safety, Guide, ILO, Kaiser, Patty, Pennwalt were the references used in the Specific Control Methods in numbers 1 - 12.

RESPIRATOR TABLE JUSTIFICATION

Patty reports that dichlorodifluoromethane has a very low toxicity. One investigator mentioned by Patty observed that dogs, guinea pigs, and monkeys were able to tolerate 200,000 ppm, with no permanent physiological damage occurring. In another investigation, it was determined that cats could tolerate 700,000 ppm for a short period. Rats exposed to 20,000 ppm exhibited no observable effects.

The ILO reports that exposures to concentrations of 50,000 ppm causes dizziness in humans. According to the AIHA Hygienic Guides, a human exposure to 100,000 ppm for a few minutes produces unconsciousness. The Hygienic Guides quote two investigators who recommend that humans not be exposed for more than "fleeting periods of concentrations much in excess of 50,000 ppm."

According to the Union Carbide Corp. MSDS, the odor of

dichlorodifluoromethane cannot be detected at concentrations below 20%.

WARNING PROPERTIES: Since dichlorodifluoromethane is practically odorless and is not an irritant, it is treated as a material with poor warning properties.

EYE IRRITATION: Grant states that "in ordinary occupational or domestic exposure to the gas there is neither ocular nor respiratory irritation. Dogs, monkeys, and guinea pigs exposed to 20% of the gas in air for several hours a day for several days showed temporary intoxication with tremors, ataxia and associated tendency to stare, salivate and lacrimate, but no cumulative toxic effect and no specific ocular disturbance. The speed of reflex closure of the eyes is such that it seems extremely unlikely that any seriuos injury would result from an accidental spray of this substance in the eyes of human beings."

IDLH: Based upon the statement by the ILO that 50,000 ppm dichlorodifluoromethane induces dizziness in humans, for the purposes of this standard, an IDLH concentration of 50,000 ppm is assumed.

LFL: Dichlorodifluoromethane is not flammable.

PERMISSIBLE EXPOSURE: 1000 ppm.

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for DICHLORODIFLUOROMETHANE

USE/EXPOSURE AND CONTROL DOCUMENT
DICHLORODIFLUOROMETHANE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of gas and skin contact with gas during manufacture and use of aerosols. (Dichlorodifluoromethane is the most commonly used aerosol propellant in the industry. It is used for cosmetics, pharmaceuticals, insecticides, paints, adhesives, cleaners, and many other products)	A,B	General dilution ventilation; personal protective equipment (gloves, goggles)
2.	Inhalation of gas and skin contact with gas or liquefied gas during manufacture and extensive use as a refrigerant (home and commercial refrigerators and freezers, small air conditioning equipment)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
3.	Inhalation of gas and skin contact with gas or liquefied gas during use as a blowing agent for cellular polymers (rigid polyurethane insulating foams, olefin polymers, nylon and polyester foams, packaging materials)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
4.	Inhalation of gas and skin contact with gas or liquefied gas during use as a solvent or diluent (in fumigants, for sterilization of some food products, in varnish and paint removers, in polymerization processes, in oil extraction and separation, in waterproofing of textiles)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
5.	Inhalation of gas and skin contact with gas during manufacture and distribution of dichlorodifluoromethane	A,B	Process enclosure; local exhaust ventilation; personal protective equipment (gloves, goggles, respiratory protective devices)

	and during maintenance of storage containers		
6.	Inhalation of gas and skin contact with gas or liquefied gas during use as a foaming agent (in fire extinguishing, in aerosols, for surfactants)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
7.	Inhalation of gas and skin contact with gas or liquefied gas during use in the Immersion Quick Freezing of food products	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
8.	Inhalation of gas and skin contact with gas or liquefied gas during miscellaneous uses (water purification, copper and aluminum purification, petroleum recovery, in the manufacture of glass bottles)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
9.	Inhalation of gas and skin contact with gas or liquefied gas during use in regulating devices (for leak detection, in thermal expansion values)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
10.	Inhalation of gas and skin contact with gas or liquefied gas during use in the manufacture of materials for electrical applications (in circuit breakers, electric generator windings, electrical insulators)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
11.	Inhalation of gas and skin contact with gas or liquefied gas during use in organic synthesis (preparation of other Freons, as polymerization catalyst)	A,B	General dilution ventilation;personal protective equipment (gloves, goggles)
12.	Inhalation of gas and skin contact with gas or	A,B	General dilution ventilation;personal protective

liquefied gas during use as a working fluid (for heat pumps, in hydraulic fluids)	equipment (gloves, goggles)

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