

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** CHLORODIPHENYL ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for CHLORODIPHENYL

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 CHLORODIPHENYL.

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 chlorodiphenyl (42 percent chlorine) in concentrations not in excess of 1 milligram per cubic meter (mg/m³) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

(2) "Action level" means one half of the permissible exposure for chlorodiphenyl (42 percent chlorine).

(b) Exposure determination and measurement.

(1) Each employer who has a place of employment in which chlorodiphenyl (42 percent chlorine) is released into the workplace air shall determine if any employee may be exposed to airborne concentrations of chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine).

(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 chlorodiphenyl (42 percent chlorine);

(ii) Any measurements of chlorodiphenyl (42 percent chlorine) taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to chlorodiphenyl (42 percent chlorine); 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 chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) 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.

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(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to chlorodiphenyl (42 percent chlorine) 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	$\pm 25\%$
At or below permissible exposure and above the action level	$\pm 35\%$
At or below the action level	$\pm 50\%$

(d) Compliance. (1) No employee shall be exposed to chlorodiphenyl (42 percent chlorine) above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine).

(ii) Spray finishing operations shall be performed in accordance with §1910.94(c).

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(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 chlorodiphenyl (42 percent chlorine) to at or below the permissible exposure; or

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

(v) In emergencies.

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

TABLE 2 RESPIRATORY PROTECTION TABLE FOR CHLORODIPHENYL (42 PERCENT CHLORINE)

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
10 mg/M3 or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
Greater than 10 mg/M3 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. (Supplied-air suits may be necessary.)
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 pesticides.

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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 chlorodiphenyl (42 percent chlorine).

(2) For the purpose of compliance with § 1910.157, chlorodiphenyl (42 percent chlorine) is classified as a Class B fire hazard.

(3) For the purpose of compliance with § 1910.106, liquid chlorodiphenyl (42 percent chlorine) is classified as a Class IIIB combustible liquid.

(4) Sources of ignition such as smoking or open flames are prohibited where chlorodiphenyl (42 percent chlorine) presents a fire or explosion hazard.

(5) Chlorodiphenyl (42 percent chlorine) shall be stored so as not to come in contact with strong oxidizers.

(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 any possibility of skin contact with liquid chlorodiphenyl (42 percent chlorine). Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that clothing contaminated with liquid chlorodiphenyl (42 percent chlorine) is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of chlorodiphenyl (42 percent chlorine) from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the chlorodiphenyl (42 percent chlorine), the employer shall inform the person performing the operation of the hazardous properties of chlorodiphenyl (42 percent chlorine).

(3) Employers shall ensure that non-impervious clothing which becomes contaminated with liquid chlorodiphenyl (42 percent chlorine) be removed promptly and not reworn until the chlorodiphenyl (42 percent chlorine) is removed from the clothing.

(4) Employers shall provide and ensure that employees use splash-proof safety goggles (cup-cover type dust and splash safety goggles) which comply with § 1910.133(a)(2)-(a)(6) where liquid chlorodiphenyl (42 percent chlorine) may contact the eyes.

(g) Spills and disposal. In the event that liquid chlorodiphenyl (42 percent chlorine) is spilled the employer shall immediately provide available ventilation and then clean up the spill.

(h) Sanitation. (1) Employers shall ensure that employees whose skin becomes contaminated with liquid chlorodiphenyl (42 percent chlorine) immediately wash or shower with soap or mild detergent and water to remove any chlorodiphenyl (42 percent chlorine) from the skin.

(2) Employers shall ensure that employees do not eat or smoke in areas where liquid chlorodiphenyl (42 percent chlorine) is handled, processed or stored.

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(3) Employers shall ensure that employees who handle liquid chlorodiphenyl (42 percent chlorine) wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

(i) Training and information. (1) Each employer who has a workplace in which chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) above the action level or employees who may have skin or eye contact with liquid chlorodiphenyl (42 percent chlorine), or employees who work where an accidental spill of chlorodiphenyl (42 percent chlorine) may occur, shall annually:

(i) Inform affected employees of the information contained in the Substance Safety Data Sheet for chlorodiphenyl (42 percent chlorine) (Appendix A of this section);

(ii) Advise affected employees as to the signs and symptoms of exposure to chlorodiphenyl (42 percent chlorine).

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of exposure to chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine).

(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 chlorodiphenyl (42 percent chlorine) or airborne concentrations of chlorodiphenyl (42 percent chlorine) 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 liver and skin.

(ii) A profile of liver function.

(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 liver function tests.

(4) The employer shall make available to each employee, exposed to chlorodiphenyl (42 percent chlorine) 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) Tests of liver function (see paragraph (j)(2)(ii) of this section).

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

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

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

(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 chlorodiphenyl (42 percent chlorine);

(ii) A description of the employee's duties as they relate to his exposure to chlorodiphenyl (42 percent chlorine);

(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 conditions which would place the employee at increased risk of material impairment of the employee's health from exposure to chlorodiphenyl (42 percent chlorine) or would directly or indirectly aggravate any detected medical condition;

(B) Any recommended limitations upon the employee's exposure to chlorodiphenyl (42 percent chlorine), 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 chlorodiphenyl (42 percent chlorine).

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

(8) No employee shall be exposed to liquid chlorodiphenyl (42 percent chlorine) or airborne concentrations of chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine).

(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.

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(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 chlorodiphenyl (42 percent chlorine).

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to chlorodiphenyl (42 percent chlorine) which are being monitored;

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

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

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

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

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

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

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

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

(ii) This record shall include:

(A) Date of training;

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

(C) Content or scope of training provided.

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

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

(ii) The record shall include:

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

(B) Any employee medical complaints relative to exposure to chlorodiphenyl (42 percent chlorine);

(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.

(1) Employee observation of measurement. (1) The employer shall give affected employees or their representatives an opportunity to observe any measurement of employee exposure to chlorodiphenyl (42 percent chlorine) which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine) 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 CHLORODIPHENYL (42 PERCENT CHLORINE)

I. SUBSTANCE IDENTIFICATION

- A. Substance: Chlorodiphenyl (42 percent chlorine)
- B. Permissible Exposure: 1 milligram of chlorodiphenyl (42 percent chlorine) per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless to dark liquid with a mild hydrocarbon odor.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Chlorodiphenyl (42 percent chlorine) 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. Every effort should be made to prevent skin, eye, oral or inhalation contact with this material.
- B. Effects of Overexposure:
 - 1. Chlorodiphenyl (42 percent chlorine) may cause irritation of the the eyes, nose and throat, and an acne-like skin rash. It may also injure your liver resulting in such effects as fatigue, dark urine and yellow jaundice. Repeated skin contact with the liquid may cause skin irritation.
 - 2. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to chlorodiphenyl (42 percent chlorine).

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If chlorodiphenyl (42 percent chlorine) gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If chlorodiphenyl (42 percent chlorine) gets on your skin, immediately wash the contaminated skin using soap or mild detergent and water. If chlorodiphenyl (42 percent chlorine) soaks through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of chlorodiphenyl (42 percent chlorine), 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.

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- D. Swallowing: When chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine). 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 chlorodiphenyl (42 percent chlorine) 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. Supplied-Air Suits: in some work situations the wearing of supplied-air suits may be necessary. Your employer should instruct you in their proper use and operation.
- C. Protective Clothing: You must wear impervious clothing, gloves, face shield, or other appropriate protective clothing to prevent any possibility of skin contact with liquid chlorodiphenyl (42 percent chlorine) Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid chlorodiphenyl (42 percent chlorine) may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Chlorodiphenyl is a combustible liquid and its vapors can form explosive mixtures with air at elevated temperatures.
- B. Chlorodiphenyl (42 percent chlorine) must be stored in tightly closed containers in a cool, well ventilated area away from heat, sparks, flames, and strong oxidizers.
- C. Sources of ignition such as smoking and open flames are prohibited wherever chlorodiphenyl (42 percent chlorine) is

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handled, used or stored in a manner that could create a potential fire or explosion hazard.

- D. If your skin becomes contaminated with liquid chlorodiphenyl (42 percent chlorine), you must immediately wash or shower with soap or mild detergent and water to remove any chlorodiphenyl (42 percent chlorine) from the skin.
- E. You must immediately remove any non-impervious clothing that becomes contaminated with liquid chlorodiphenyl (42 percent chlorine) and this clothing must not be reworn until the chlorodiphenyl (42 percent chlorine) is removed from the clothing.
- F. You must not eat or smoke in areas where liquid chlorodiphenyl (42 percent chlorine) is handled, processed or stored.
- G. If you handle liquid chlorodiphenyl (42 percent chlorine), you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.
- H. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
- I. Ask your supervisor where chlorodiphenyl (42 percent chlorine) 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 chlorodiphenyl (42 percent chlorine). In addition, your employer must instruct you in the safe use of chlorodiphenyl (42 percent chlorine), emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to chlorodiphenyl (42 percent chlorine). 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 CHLORODIPHENYL (42 percent CHLORINE)

I. PHYSICAL AND CHEMICAL DATA

A. Substance Identification

1. Synonyms: Polychlorinated biphenyl; PCB
2. Formula: C₁₂H₇Cl₃ (approximately)
3. Molecular weight: 257.5 (approximately)

B. Physical Data

1. Boiling point (760 mm Hg): 325 - 366 C (617 - 691 F)
2. Specific gravity (H₂O = 1): 1.38
3. Vapor density (air = 1 at boiling point of chlorodiphenyl (42 percent chlorine): 8.9
4. Melting point: -19 C (-2 F) (Pour point)
5. Vapor pressure at 20 C (68 F): 0.001 mm Hg
6. Solubility in water, % by weight at 20 C (68 F): insoluble
7. Evaporation rate (butyl acetate = 1): much less than 1
8. Appearance and odor: Colorless to dark liquid with a mild hydrocarbon odor.

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: 176 C (349 F)
2. Autoignition temperature: None to boiling point
3. Flammable limits in air, % by volume: not available
4. Extinguishing media: Foam, dry chemical, carbon dioxide
5. Special fire-fighting procedures: Do not use a solid stream of water since a stream will scatter and spread the fire. Use water spray to cool containers exposed to a fire.
6. Unusual fire and explosion hazards: Liquid chlorodiphenyl (42 percent chlorine) is a combustible liquid. At elevated temperatures its vapors can form explosive mixtures with air. All ignition sources must be controlled where chlorodiphenyl (42 percent chlorine) is used, handled, or stored in a manner that may present a potential fire or explosion hazard.
7. For purposes of complying with the requirements of 29 CFR 1910.106, liquid chlorodiphenyl (42 percent chlorine) is classified as a Class IIIB combustible liquid.

B. Reactivity

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact with strong oxidizing agents may cause fire and explosions.
3. Hazardous decomposition products: Toxic gases and vapor (such as hydrogen chloride and carbon monoxide) may be

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released in a fire involving chlorodiphenyl (42 percent chlorine).

4. Special precautions: Chlorodiphenyl (42 percent chlorine) will attach some forms of plastics, rubber and coatings.

III. SPILL, LEAK, AND DISPOSAL PROCEDURES

- A. If chlorodiphenyl (42 percent chlorine) is spilled or leaked, the following steps should be taken:
 1. Remove all ignition sources.
 2. Ventilate area of spill or leak.
 3. Collect for reclamation or absorb in vermiculite, dry sand, earth or a similar material.
- B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been complete.
- C. Waste disposal methods: Chlorodiphenyl (42 percent chlorine) may be disposed of by absorbing in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

IV. MONITORING AND MEASUREMENT PROCEDURES

- A. Exposure above the action level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Several short time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84. Portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of chlorodiphenyl (42 percent chlorine) to plus or minus 35%.
- B. Exposure above the permissible exposure: The monitoring and measurements under this section should be essentially the same as described under paragraph (IV)(A). Laboratories performing chemical analysis should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of chlorodiphenyl (42 percent chlorine) 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

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- A. Store chlorodiphenyl (42 percent chlorine) in tightly closed containers in a well ventilated area.
- B. Employers should advise employees of all areas and operations where exposure to chlorodiphenyl (42 percent chlorine) could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to chlorodiphenyl (42 percent chlorine) is likely to occur are: during its use as a transformer fluid; for impregnating papers, cloths, etc. for heat, moisture and chemical resistance properties; as a heat transfer fluid, lubricant, and wax extender; in the compounding of sealing compounds and printing inks; as a plasticizer; in the manufacture of insecticides, pesticides and fungicides; in cutting oils; and during its production.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption.

II. TOXICOLOGY

Chlorodiphenyl, (42 percent chlorine) vapor is toxic to the liver and causes an acne-form dermatitis (chloracne). Guinea pigs died at intervals up to 21 days after the first of 11 daily applications of 34.5 mg to the skin and at necropsy, the liver showed fatty degeneration and central atrophy; rats, however, survived 25 daily applications and only slight changes in the liver were observed. The vapor and liquid are moderately irritating to eye tissues. Cases of mild to moderate skin irritation with an acne-form eruption have been reported in workers exposed to 0.1 mg/m³; levels of 10 mg/m³ were unbearably irritating. Several deaths due to atrophy of the liver occurred among workers exposed to the fumes of chlorodiphenyls and chloronaphthalenes. Relatively few, if any, reports of systemic poisoning of workers exposed only to chlorinated diphenyl have appeared.

III. SIGNS AND SYMPTOMS

Eye irritation; chloracne; may cause liver injury.

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.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of chlorodiphenyl, (42 percent chlorine) are caused by its capacity to produce an acne-form dermatitis and to affect the liver. It is important that the physician becomes familiar with plant operating conditions in which exposure to chlorodiphenyl, (42 percent chlorine) occurs. Those with skin disease may not tolerate the wearing of protective clothing and those with chronic respiratory disease may not tolerate the wearing of negative pressure respirators.

B. PREPLACEMENT

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The following medical procedures must be made available to each employee who is exposed to chlorodiphenyl, (42 percent chlorine):

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 monitoring. Examination of liver and skin should be stressed. The skin should be examined for evidence of chronic disorders.

C. PERIODIC EXAMINATIONS

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

References

1. American Conference of Governmental Industrial Hygienists: "Chlorodiphenyl-42 percent Chlorine--Skin," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, pp. 51-52.
2. Hygienic Guide Series: "Chlorodiphenyls," American Industrial Hygiene Association Journal, 26:92-94, 1965.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1340-1343.

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REFERENCES AND SOURCES
CHLORODIPHENYL (42 PERCENT CHLORINE)
1910.93

- (f) Personal Protective Equipment, and, (h) Sanitation
Eye: American Industrial Hygiene Association, Hygienic Guide Series,
"Chlorodiphenyls"
Skin: American Industrial Hygiene Association, Hygienic Guides Series,
"Chlorodiphenyls;" Kirk-Othmer, "Encyclopedia of Chemical Techno-
logy;" Faizhall, "Industrial Toxicology;" Toxic Substances List
1973; Patty, "Industrial Hygiene and Toxicology"
Ingestion: American Industrial Hygiene Association, Hygienic Guides
Series, "Chlorodiphenyl;" Patty, "Industrial Hygiene and Toxicology"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

According to the Hygienic Guide Series "the liquid products
. . . are moderately irritating to eye tissues."

Skin - Classification: 1

Output statement numbers: 1, 7a, 14i, 17g, 20a

Exceptions: 8 deleted because of insolubility; 7a sub-
stituted for 6; 17g substituted for 14g.

The Hygienic Guide Series state that the compound is
"readily absorbed through the clipped, intact skin of
rabbits for 24 hours." It continues, "local action on
the skin is similar to that of common organic solvents
where contact leads to removal of the natural fats and
oils with subsequent drying and cracking of the skin."
The Toxic Substance List sets the MLD for rabbit skin
exposure at 794 mg/kg. Kirk-Othmer states "repeated bodily
contact with liquid Aroclors may lead to an acne-form skin
eruption." Patty reports work in which 42 percent chlorodiphenyl
was applied to the skin of guinea pigs in doses of 1/40
of 1 ml for 11 days, with death following within 21 days
after the first application. "Histopathological examina-
tion of the liver showed fatty degeneration and central
atrophy; there was a thickening of the epidermis at the
site of application," according to Patty. A similar
experiment in rats showed only slight changes in the liver
although the skin was thickened and hair follicles swollen;
after carrying out the experiment on rabbits, investigators
found liver damage more severe than in the guinea pigs as
well as "thinning of the prickle cell layer and a relative
thickening of the outer cornified layers" of the treated
skin. These data indicate that chronic skin exposure to
very small amounts can be harmful. They also suggest that
a single exposure to a larger amount which is not removed
immediately from the skin would also be harmful. It
is concluded that a classification of 1 is justified. The
flashpoint of the substance is greater than 200 F. Its
vapor pressure at 25 C is about 0.006 mm Hg. A pour point
of about -2 F is given so the substance is usually a

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liquid in the workplace. Since the substance is not soluble in water, deluge showers are not specified and statement 14i is modified to read "immediately wash or shower with soap or mild detergent and water." The AIHA Guide indicates this as the proper response. Statement 6 is considered too stringent and is replaced by 7a. Statement 17g is substituted for 14g as prompt removal of clothing which occasionally becomes contaminated is considered sufficient.

Ingestion - Classification: 1

Output statement numbers: 19, 20a

Exceptions: None

The Hygienic Guide cites work which set the oral rat LD50 at approximately 8.65 gm/kg. The primary result appears to be control atrophy of the liver. Patty cites work in which two doses of 0.05 ml (69 mg) 42 percent chlorodiphenyl were given to guinea pigs one week apart, with death following in 11 to 29 days. Upon autopsy "the livers showed metamorphosis and central atrophy." In other work reported by Patty, rats were dosed with .1 ml (139 mg)/day for 25 days; the animals survived the dosing and were killed at various intervals following the final dose. Liver injury was found upon examination. The data are sufficient to indicate that repeated, small oral doses can lead to liver damage. Consequently, a classification of 1 is specified though the AIHA indicates that ingestion is not a problem in industry.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

Monsanto Co., "Arochlor Plasticizers," Technical Bulletin O/PL-306A
(Mons)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition,
Vol. 5, p. 289 (K-O)

Sources of data items used:

- I.
 - A.
 - 1. Synonyms: Mons
 - 2. Formula: Mons
 - 3. Molecular weight: Mons
 - B.
 - 1. Boiling point: Mons
 - 2. Specific gravity: Mons
 - 3. Vapor density: calculated
 - 4. Melting point: Mons
 - 5. Vapor pressure: Mons
 - 6. Solubility in water: Mons
 - 7. Evaporation rate: Mons
 - 8. Appearance and odor: Mons
- II.
 - A.
 - 1. Flash point: Mons
 - 2. Autoignition temperature: Mons
 - 3. Flammable limits: not available
 - 4. Extinguishing media: ADL
 - 5. Special fire fighting procedures: ADL
 - 6. Unusual fire and explosion hazards: ADL
 - B.
 - 1. Conditions contributing to instability: ADL
 - 2. Incompatibilities: ADL

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- 3. Hazardous decomposition products: ADL
- 4. Special precautions: K-O
- III. A. Steps if released or spilled: ADL
- C. Waste disposal method: ADL
- V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

Sources used in the preparation of this document include:

- "The Aroclor Compounds," Product Bulletin, Monsanto Chemical Company (Bull)
- "Chlorodiphenyls," Hygienic Guide Series, American Industrial Hygiene Association, January - February, 1965 (Guide)
- Derra, Rolf, "The PCB Problem and Its Significance for the Paper Industry," Wochenbl. Papierfabr, (Ger.), 101(9), 1973 (Derra)
- Doolittle, Arthur K., "The Technology of Solvents and Plasticizers," John Wiley and Sons, Inc., 1954 (Doolittle)
- Elkins, H. B., "Chemistry of Industrial Toxicology," John Wiley and Sons, Inc., 2nd edition, 1959 (Elkins)
- Ellis, Carleton, "Printing Inks - Their Chemistry and Technology," Reinhold Publishing Corporation, New York, 1940 (Ellis)
- Gafafer, W. M. - editor, "Occupational Diseases - A Guide to Their Recognition," U. S. Department of HEW, 1966 (Gafafer)
- Gleason, N. M., et al, "Chemical Toxicology of Commercial Products," Williams and Wilkins Co., Baltimore, 1969 (Gleason)
- Hamilton, A. and Hardy, H. L., "Industrial Toxicology," Publishing Sciences Group, Inc., 3rd edition, 1974 (Hamilton and Hardy)
- "Handbook of Hazardous Materials," American Mutual Insurance Alliance, Technical Guide No. 7, 1974 (AMICA)
- Hawley, G. G., editor, "The Condensed Chemical Dictionary," Van Nostrand - Reinhold Company, 8th edition, 1971 (Hawley)
- Ishikawa, H., "Hot-Melt Adhesives," Japan Patent 70 - 41, 519, December 26, 1970 (Ishikawa)
- Jacobs, M., "The Analytical Chemistry of Industrial Poisons, Hazards, and Solvents," Interscience Publishers, 1956 (Jacobs)
- Kamp, E. and Jahn, K., "Plastic Vessel Coated with Epoxy Resin Containing Lacquer," U. S. Patent 3,393,087, July 16, 1968 (Kamp)
- Khozin, V. G., Voskresenskii, V. A., "Improvements in the Construction Properties of Epoxy Resins by Modification with Polychlorobiphenyl," IZV. Vyssh. Ucheb. Zaved., Stroit. Arkhitekt., (russ), 15(11), 1972 (Khozin)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 1st edition, 1954 (Chem Tech)
- Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley and Sons, Inc., 2nd edition, 1968 (K-O)
- Lefaux, R., "Practical Toxicology of Plastics," CRC Press, International Science Series, 1968 (Lefaux)
- LeMar, R. L., "Effects of Thermal Degradation on the Lubrication Properties of Fluids," ASLE TRANS., 10(4), 1967 (LeMar)
- Meigs, J. W., Albom, J. J. and Karten, B. L., "Chloracne from An Unusual Exposure to Aroclor," J.A.M.A., Vol. 154:No. 17, April 24, 1954 (Meigs)
- Oda, Ryohei, et al, "Smudge-Resistant Record-Transfer Sheets Useful in Dupli-

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cating and Manifolding Operations," U. S. Patent 3,389,007, June 18, 1968 (Oda)

Plunkett, E. R., "Handbook of Industrial Toxicology," Chemical Publishing Company, Inc., 1966, (Plunkett)

"Skin Hazards in American Industry - Part II - Dermatitis in the Manufacture of Synthetic Resins and Waxes," U. S. Public Health Service Bulletin, No. 229 (Public Health)

References for Specific Use/Exposures

1. Guide, Meigs, Gafafer, K-O, Bull, Elkins, Hawley
2. Guide, Meigs, K-O, Gafafer, Jacobs, Plunkett, Elkins
3. K-O, Bull, Hamilton and Hardy
4. K-O, Doolittle, Gafafer, Bull
5. Guide, K-O, Bull, Ishikawa
6. K-O, Gafafer, Bull, Doolittle, Gleason, Public Health
7. Guide, K-O, Bull
8. K-O, Bulletin, Plunkett, Hamilton and Hardy, LeMar
9. Hawley
10. Contractor estimate
11. Hawley, Guide, Bull, Doolittle, Lefaux, Plunkett, Hamilton and Hardy, Kamp, Khozin
12. Hawley, Gafafer, Bull
13. Hamilton and Hardy, Bull
14. Bull
15. K-O, Derra
16. Hawley, Oda
17. Bull
18. K-O, Bull
19. Gafafer, Bull, Ellis, Derra

References for Specific Control Methods

1. Guide, Chem Tech, AMICA, Plunkett
 2. Guide, AMICA, Public Health, Chem Tech, Jacobs, Plunkett
- Guide, Chem Tech, AMICA, Jacobs and Plunkett were the references used for the Specific Control Methods in numbers 3 - 11.
12. Guide, AMICA, Public Health, Chem Tech, Jacobs, Plunkett
 13. Guide, Chem Tech, AMICA, Jacobs, Plunkett
 14. Guide, AMICA, Public Health, Chem Tech, Jacobs, Plunkett
- Guide, Chem Tech, AMICA, Jacobs and Plunkett were the references used for the Specific Use/Exposures in numbers 15 - 19.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 1 mg/M3.

WARNING PROPERTIES: According to the AIHA Hygienic Guides, chlorodiphenyl (42 percent chlorine) has a typical aromatic odor and causes eye irritation. For the purposes of this standard, however, chlorodiphenyl (42 percent chlorine) is treated as a material with poor warning properties, as there are no quantitative data available concerning its odor and irritation thresholds.

EYE IRRITATION: As stated in the AIHA Hygienic Guides, the vapors of the chlorodiphenyls are "moderately irritating to eye tissues." The concentrations causing eye irritation are not mentioned.

LFL: Chlorodiphenyl (42 percent chlorine) is not flammable.

IDLH: 10 mg/M3.

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IDLH BASIS: In the absence of any other information upon which to base an IDLH concentration for chlorodiphenyl (42 percent chlorine), the IDLH of 10 mg/M3 chlorodiphenyl (42 percent chlorine), which has been assumed for the purposes of this standard, is based upon the human TCL0 of 10 mg/M3 given in the NIOSH Toxic Substances List.

SUMMARY OF TOXICOLOGY:

The AIHA Hygienic Guides describe experiments in which cats, mice, rabbits, rats, and guinea pigs were exposed chronically to 8.6 mg/M3 and 6.83 mg/M3 chlorodiphenyl (42 percent chlorine). The only observable effect produced by these exposures was poor growth in guinea pigs which had been exposed to the higher concentration for 17 7-hour exposures over a period of 24 days. No effects were observed in the animals exposed to the lower concentration following 84 exposures, for 7 hours per day.

The Hygienic Guides state that chlorodiphenyl (42 percent chlorine) is readily absorbed through the intact skin of rabbits. "The minimum lethal dose when the undiluted materials were applied to the covered, clipped, intact skin of rabbits for 24 hours was approximately 1.0 gm/kg for the 42 percent chlorinated (diphenyl)."

The NIOSH Toxic Substances List (citing Elkins, p. 153) gives a human TCL0 of 10 mg/M3. TCL0 is defined as the "Toxic Concentration Low -- Any concentration of a substance in air to which man or animals have been exposed for any given period of time and that has been reported to produce any toxic effect in man, or to produce a carcinogenic, teratogenic, mutagenic, or neoplastic toxic effect in animals or humans." The toxic effect produced by the exposure to 10 mg/M3 chlorodiphenyl (42 percent chlorine) is, according to the Toxic Substances List, "an irritant effect - any irritant effect on the skin, eye, or mucous membrane."

VAPOR PRESSURE AT 20 C: .001 mm.

SATURATED AIR CONCENTRATION: 1.3 ppm.

Saturated concentration at 20 C is approximately 14 mg/M3.

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CHLORODIPHENYL (42 PERCENT CHLORINE)

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of vapor or aerosol where used as a high temperature heat transfer medium (marketed as aroclor, chlorextol, and therminol). Applications include indirect heating systems such as chemical and food processing vessels and drying ovens.	A	General dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, goggles)
2.	Inhalation of vapor and skin contact with liquid during manufacture and handling of transformers, capacitors, resistors, and other electrical apparatus in which chlorodiphenyl is used as a dielectric. Applications include industrial and residential equipment and appliances.	A, B, D	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons, goggles)
3.	Inhalation of vapor and skin contact with liquid during formulation of and spray application of surface coatings (paints, varnishes and lacquers based on cellulosis, vinyls, epoxies and phenolics) in which chlorodiphenyl is used as a plasticizer, flame retardant and to impart weather resistance, luster, adhesion	A, B, D	Process enclosure (spray applications); general dilution ventilation; local exhaust ventilation; personal protective equipment (respiratory protective devices, gloves, aprons and goggles)
4.	Inhalation of vapor and skin contact with liquid when used in the manufacture of and during the application of impregnants for cloth, paper, fiberboard, wood and asbestos. Such	A, B, D	General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles)

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compounds impart moisture and gas resistance, insulating properties, alkali and chemical resistance, flame resistance or lubricating qualities to the impregnated materials

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| 5. | Inhalation of vapor and skin contact with liquid when used in the manufacture of and during application of hot-melt and other adhesives (cellulosics, vinyls, rubbers, urethanes and epoxies) | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |
| 6. | Inhalation of vapor and skin contact with liquid when used in the manufacture of and during the application of natural and synthetic waxes and polishes. Such compounds are applied to wood, leather, linoleum, and metal and have excellent flame resistance, moisture resistance and adhesion | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |
| 7. | Inhalation of vapor or aerosol where used as the non-flammable working fluid in vacuum pumps (diffusion type), hydraulic systems and expansion systems, such as thermostats, regulators, bellows, and other automated equipment | A | General dilution ventilation; local exhaust ventilation |
| 8. | Skin contact with liquid when used in the manufacture of and during application of high pressure, temperature and moisture lubricants | B,D | Personal protective equipment (gloves, aprons and goggles) |
| 9. | Inhalation of vapor or aerosol and skin contact | A,B,D | General dilution ventilation; local exhaust ventila- |

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- with liquid when used as an intermediate or raw material in further organic synthesis
10. Inhalation of vapor and skin contact with liquid during cleaning and maintenance of chlorodiphenyl processing equipment such as reactors and storage vessels. A,B,D Personal protective equipment (respiratory protective devices, gloves, aprons, barrier creams and goggles)
11. Inhalation of vapor and skin contact with liquid during compounding and processing of such plastics as cellulose, vinyls, natural and synthetic rubbers, epoxies, polyethylenes, polyesters, phenolics and asphalts in which chlorodiphenyl is used as a plasticizer or flame retardant. A,B,D General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles)
12. Inhalation of vapor and skin contact with liquid or powder when used in the manufacture of and during application of insecticides, pesticides and fungicides. A,B,D General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles)
13. Skin contact with liquid during use of specialty cutting oils containing chlorodiphenyl. B,D Personal protective equipment (gloves, aprons and goggles)
14. Inhalation of vapor and skin contact with liquid when used as a sealer for gaskets of natural rubber and synthetics (Hycar, Koroseal, PerBuna H and Neoprene). A,B,D General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles)
15. Skin contact with liquid during the manufacture of pressure-rupturable capsules for adhesive release on tapes and tion; personal protective equipment (respiratory protective devices, gloves, and goggles) Personal protective equipment (gloves, aprons and goggles)

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ink release on carbonless
duplicating paper

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| 16. | Skin contact with liquid when used as a carrier for pigments in dyeing polyesters and paper. | B,D | Personal protective equipment (gloves, aprons and goggles) |
| 17. | Inhalation of vapor and skin contact with liquid during manufacture of "permanent-tack" coating for fabrics and paper used in insect traps, tapes and sign backings | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |
| 18. | Inhalation of vapor and skin contact with liquid when compounding mastics, sealing and caulking materials | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |
| 19. | Inhalation of vapor and skin contact with liquid when compounding printing inks | A,B,D | General dilution ventilation; local exhaust ventilation; personal protective equipment (gloves, aprons and goggles) |

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