

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** PARATHION ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for PARATHION

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 PARATHION.

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 exposure of employees to airborne concentrations of parathion not in excess of 0.1 milligrams per cubic meter (mg/M3) averaged over an eight-hour work shift (time weighted average), as stated in § 1910.1000, Table Z-1.

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

(b) Initial determination and exposure measurement. (1) Each employer who has a place of employment in which parathion is released into the workplace air shall determine if there is any possibility that any employee may be exposed to airborne concentrations of parathion above the permissible level. The initial determination shall be made each time there is a change in production, process, or control measures which may result in an increase in airborne concentrations of parathion.

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

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

(ii) Any measurements of parathion taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to parathion; and

(iv) Date of initial determination, work being performed at the time, location within work site, and employees considered.

(3) If the employer determines that any employee may be exposed to parathion above the permissible exposure, 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 parathion above the action level, the employer shall:

(i) Identify all employees who may be exposed above the permissible level; and

(ii) Measure the exposure of the employees so identified.

(5) If an employee exposure measurement reveals that an employee is exposed to parathion above the action level, but not above the permissible exposure, the exposure of that employee shall be measured at least every three months.

(6) If an employee exposure measurement reveals that an employee is exposed to parathion 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 parathion above the permissible exposure. The employee shall also be notified of the results of the exposure measurements and of the corrective action being taken to reduce the exposure to below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to parathion 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.

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(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 percent, of not less than that given in Table 1.

Table 1

Concentration	Required Accuracy
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Above permissible exposure	$\pm 25\%$
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At or below permissible exposure	
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and above the action level	$\pm 35\%$
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At or below the action level	$\pm 50\%$
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(d) Compliance. (1) No employee shall be exposed to parathion above the permissible exposure as defined in paragraph (a)(1) of this section.

(2) Employee exposures to airborne concentrations of parathion 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 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 local exhaust is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity or static pressure, 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 parathion.

(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 not feasible; or

(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of parathion to at or below the permissible exposure; or

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

(v) In emergencies.

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(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. When an employee informs his employer that he is experiencing eye irritation from parathion while wearing a respirator allowed in Table 2, the employer shall provide and ensure that the employee use an equivalent respirator with a full facepiece, helmet, or hood.

TABLE 2 RESPIRATORY PROTECTION FOR PARATHION

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION*
Particulate or Vapor Concentration	
1 mg/M3 or less	Any chemical cartridge respirator with organic vapor cartridge(s) and dust, fume, and mist filter(s).** Any supplied-air respirator. Any self-contained breathing apparatus.
5 mg/M3 or less	A chemical cartridge respirator with a full facepiece, organic vapor cartridge(s) and dust, fume, and mist filter(s).** A gas mask with a chin style or a front-or back-mounted organic vapor canister and dust, fume, and mist filter.** Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
20 mg/M3 or less	A powered chemical cartridge respirator with an organic vapor cartridge and high efficiency particulate filter.** A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 20 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.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure

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mode.

Escape Any gas mask providing protection against organic vapors and
particulates.

Any escape self-contained breathing apparatus.

* Use of supplied-air suits may be necessary to prevent skin contact and respiratory exposure from airborne concentrations of parathion. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitation and potential life endangering characteristics of supplied-air suits. Where supplied-air suits are used above a concentration which may be immediately dangerous to life and health (20 mg/M3), an auxiliary positive-pressure self-contained breathing apparatus must also be worn.

** Including pesticide respirators which meet the requirements of this class.

(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 parathion.

(2) Parathion 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 appropriate protective clothing and equipment necessary to prevent any possibility of skin contact with parathion. Face shields shall comply with § 1910.133 (a)(2), (a)(4), (a)(5), and (a)(6).

(2) Employers shall ensure that employees whose clothing has had any possibility of being contaminated with parathion change into uncontaminated clothing before leaving the work premises.

(3) Employers shall ensure that clothing which has had any possibility of being contaminated with parathion is placed in closed containers for storage until it can be discarded or until the employer provides for the removal of parathion from the clothing. If the clothing is to be laundered or otherwise cleaned to remove the parathion, the employer shall inform the person performing the operation of the hazardous properties of parathion.

(4) Where there is any possibility of exposure of an employee's body to parathion, employers shall provide facilities for quick drenching of the body within the immediate work area for emergency use.

(5) Employers shall ensure that non-impervious clothing which becomes contaminated with parathion be removed immediately and not reworn until the parathion is removed from the clothing.

(6) Employers shall provide and ensure that employees use splash-proof safety goggles which comply with § 1910.133 (a)(2)-(a)(6) where there is any possibility of parathion contacting the eyes.

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(7) Where there is any possibility that an employee's eyes may be exposed to parathion, employers shall provide an eye-wash facility within the immediate work area for emergency use.

(g) Spills and disposal. In the event that liquid parathion 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 parathion immediately wash or shower with soap or mild detergent and water to remove any parathion from the skin.

(2) Employers shall ensure that all employees subject to skin contact with parathion wash with soap or mild detergent and water any areas of the body which may have contacted parathion at the end of each workday.

(3) Employers shall ensure that employees do not eat or smoke in areas where parathion is handled, processed or stored.

(4) Employers shall ensure that employees who handle parathion 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 parathion 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 parathion above the action level without regard to the use of respirators, or employees who may have any possibility of skin contact or eye contact with parathion, or employees who work where a spill of parathion may occur, shall annually:

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

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

(iii) Instruct affected employees to advise the employer of the development of signs and symptoms of overexposure to parathion 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 parathion.

(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) Preplacement medical examination. The employer shall make available to each employee who is exposed, or will be exposed, to airborne concentrations of parathion above the action level, without regard to the use of respirators, or employees who may have any possibility of skin or eye contact with parathion, a preplacement medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the lungs, skin, nervous system, and heart.

(ii) A determination of cholinesterase activity in serum and red blood cells.

(3) Periodic medical examination. The employer shall make available to each employee exposed to airborne concentrations of parathion above the action level, without regard to the use of respirators, or employees who

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may have any possibility of skin or eye contact with parathion, from the date of the employee's first exposure, a periodic medical examination which must include the following:

(i) A medical history and physical examination with emphasis on the lungs, skin, nervous system, heart to be performed annually;

(ii) A determination of cholinesterase activity in serum and red blood cells to be performed quarterly.

(4) Alternative medical procedures. If the examining physician chooses to use alternative medical procedures to those specified in paragraphs (j)(2) and (j)(3) of this section, the employer may accept such alternative medical procedures as meeting the requirements of this section provided that the employer:

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

(ii) Informs each exposed worker of the fact that alternative medical procedures to those required in paragraphs (j)(2) and (j)(3) of this section are to be made available.

(5) Interim medical examination. The employer shall provide an interim medical examination including a determination of cholinesterase levels for the employee if the employee informs the employer of any of the signs or symptoms of exposure to parathion which are listed in Appendix A or at anytime overexposure to parathion is suspected.

(6) Informing the physician. The employer shall provide to the physician performing any medical examination required by this section the following information:

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

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

(iii) A description of any personal protective equipment and 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.

(7) Where a medical examination is required by paragraphs (j)(2), (j)(3), or (j)(5) of this section, following such examination the employer shall obtain from the examining physician a written opinion which conforms with paragraph (j)(8) of this section.

(8) Physician's written opinion. (i) The physician's written opinion by the examining physician shall specifically state:

(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 parathion;

(B) Any recommended limitations upon the employee's exposure to parathion, 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 the employee's employment.

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

(9) Results of tests. Where a preplacement or periodic medical examination is required by paragraphs (j)(2) or (j)(3) of this section, following such examination the employer shall obtain from the examining physician for inclusion in the employee's medical record:

(i) A recording of the results of the cholinesterase determination;

(ii) Where alternative medical procedures have been performed in accordance with paragraph (j)(4) of this section, a recording of such alternative procedures.

(10) No employee shall be exposed to parathion in such a way as would put the employee at increased risk of material impairment of his health from such exposure. The employer shall base this decision on any information available including the physician's written opinion.

(11) No medical procedure which would be performed pursuant to paragraphs (j)(2) or (j)(3) of this section need be performed if records of a previous such procedure performed within the past six months are acceptable to the examining physician.

(12) 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.

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

(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) This 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 parathion.

(ii) This record shall include:

(A) The date of measurement;

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

(C) Sampling and analytical method used and evidence of their accuracy;

(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.

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(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) The name and social security number of the employee;

(B) Results of tests required by paragraph (j)(2) and (j)(3) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

(C) Any employee medical complaints relative to exposure to parathion;

(D) A copy of information provided to the physician pursuant to paragraph (j)(6)(ii), (iii), (iv), (v), and (vi) of this section.

(E) Physician's written opinion; and

(F) A signed statement of any refusal to be examined.

(iii) This record shall be maintained for the duration of and for five years after termination 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) Each employee or former employee shall have access to the exposure determination and exposure measurement records required to be maintained by this section which indicate his own exposure to parathion.

(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 each employee or his representative an opportunity to observe any measurement of his exposure to parathion which is conducted pursuant to this section.

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

(iii) Record the results obtained.

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NOTE: The information contained in the following appendix for parathion is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent the information supplements this regulation for parathion, it is advisory in nature.

APPENDIX A

SUBSTANCE SAFETY DATA SHEET
FOR PARATHION

I. SUBSTANCE IDENTIFICATION

- A. Substance: Parathion
- B. Permissible Exposure: 0.1 milligram of parathion per cubic meter of air (mg/M3) averaged over an eight-hour work shift.
- C. Appearance and Odor: Yellow to dark brown liquid with a characteristic odor, like garlic

II. HEALTH HAZARD DATA

- A. Ways in which the chemical affects your body: Parathion 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 enter your body through your skin.
- B. Effects of Overexposure:
 - 1. Short-term Exposure: After inhalation of parathion, breathing and eye effects are the first to appear. These include tightness of the chest, wheezing, a bluish discoloration of the skin, small pupils, aching in and behind the eyes, blurring of vision, tearing, runny nose, headache, and watering of the mouth. After swallowing parathion, loss of appetite, nausea, vomiting, abdominal cramps and diarrhea may appear within two hours. After skin absorption, sweating and twitching in the area of absorption may occur usually within 15 minutes to four hours. With severe intoxication by all routes, in addition to the above symptoms, weakness, generalized twitching and paralysis may occur and breathing may stop. In addition, dizziness, confusion, staggering, slurred speech, generalized sweating, irregular or slow heartbeat, convulsions and coma may occur.
 - 2. Long term Exposure: Repeated exposure to parathion may make you more susceptible to the effects of this and related chemicals. Repeated exposure to concentrations which are too small to produce symptoms after a single exposure may result in the onset of symptoms.

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

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If parathion or parathion mists get 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 parathion or parathion mists get on your skin, immediately wash the contaminated skin using soap or mild detergent and water. If parathion or parathion mists penetrate through your clothing, remove the clothing immediately and wash the skin using soap or mild detergent and water. Get medical attention immediately.
- C. Breathing: If you or any other person breathes in large amounts of parathion, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the affected person warm and at rest. Get medical attention as soon as possible.
- D. Swallowing: When parathion has been swallowed and the person is conscious, give the person large quantities of water immediately. After the water has been swallowed, try to get the person to vomit by having him touch the back of his throat with his finger. Do not make an unconscious person vomit. Get medical attention immediately.
- 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 emergency rescue equipment before the need arises.

IV. RESPIRATORS AND PROTECTIVE CLOTHING

- A. Respirators: Respirators are not the best way to control exposure to parathion. 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 parathion 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 Suits: In some work situations the wearing of supplied-air suits or other impervious coverings such as acid

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suits may be necessary. Your employer should instruct you in their proper use and operation.

- C. Protective Clothing: You must wear appropriate protective clothing and equipment to prevent any possibility of skin contact with parathion. Replace or repair impervious clothing that has developed leaks.
- D. Eye Protection: You must wear splash-proof safety goggles where there is any possibility of parathion contacting your eyes.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Parathion must be stored in tightly closed containers in a well-ventilated area away from strong oxidizers.
- B. If your work clothing has had any possibility of being contaminated with parathion, you must change into uncontaminated clothing before leaving the work premises.
- C. You must immediately remove any non-impervious clothing that becomes contaminated with parathion and this clothing must not be reworn until the parathion is removed from the clothing.
- D. If your skin becomes contaminated with parathion, you must immediately wash or shower with soap or mild detergent and water to remove any parathion from your skin.
- E. If you are subject to skin contact with parathion, at the end of each work day you must wash with soap or mild detergent and water any areas of the body which may have contacted parathion.
- F. You must not eat or smoke in areas where parathion is handled, processed or stored.
- G. If you handle parathion, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking and using toilet facilities.
- H. Quick drenching facilities and eye flushing facilities, where provided, must be readily available and you should know where they are and how to operate them.
- I. Ask your supervisor where parathion is used in your work area and for any additional 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 parathion. In addition, your employer must instruct you in the safe use of parathion, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being exposed to parathion. 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 the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of your exposure and medical examinations. Your employer is required to keep exposure data for at least one year and to keep medical data

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- during your employment, and for a period of five years following your termination of employment. Your employer is required to make the exposure data available to you upon your request. Your employer is also required to release your medical records to your physician upon your written request.
- D. Your employer must give you a copy of the physicians written opinion for any physical examination required by this standard.

NOTE: The information contained in the following appendix for parathion is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligation. To the extent that the information supplements this regulation for parathion, it is advisory in nature.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
PARATHION

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: o,o-diethyl-o,p-nitrophenyl phosphorothioate; ethyl parathion
 2. Formula: $(C_2H_5O)_2 PSOC_6H_4NO_2$
 3. Molecular weight: 291.3
- B. Physical Data
1. Boiling point (760 mm Hg): 375 C (707 F) (calculated)
 2. Specific gravity (water = 1): 1.27
 3. Vapor density (air = 1 at boiling point of parathion): Not applicable
 4. Melting point: 6 C (43 F) (pure grade); 0 C (32 F) (technical)
 5. Vapor pressure at 20 C (68 F): 0.0004 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): .00002
 7. Evaporation rate (butyl acetate = 1): Not applicable
 8. Appearance and odor: Yellow to dark brown liquid with a characteristic odor, like garlic
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Not combustible
- B. Reactivity
1. Conditions contributing to instability: Temperatures above 100 C (212 F) may cause decomposition so that containers burst.
 2. Incompatibilities: Contact with strong oxidizers may cause fires and explosions.

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3. Hazardous decomposition products: Toxic gases and vapors (such as oxides of nitrogen, phosphorus and sulfur, and carbon monoxide) may be released when parathion decomposes.
4. Special precautions: Parathion will attack some forms of plastics, rubber and coatings.

III. SPILL, LEAK AND DISPOSAL PROCEDURES

- A. If parathion is spilled or leaked, the following steps should be taken:
 1. Ventilate area of spill or leak.
 2. 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 completed.
- C. Waste disposal methods: Parathion may be disposed of by absorbing in vermiculite, dry sand, earth or similar material and disposing in sealed containers 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 eight-hour exposure may be determined from a single eight-hour sample or two four-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 (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by collection of the particulates and vapors using a high efficiency membrane filter followed by an adsorption tube with subsequent chemical analysis of both the filter and adsorption tube. Detector tubes certified by NIOSH under 42 CFR part 84 or other direct-reading devices calibrated to measure parathion may be used. The method of measurement must determine the concentration of parathion 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 above. More than three (3) measurements should be taken during the work shift so that increased confidence may be placed in the judgement that the employee has or has not, in fact, been exposed in excess of the permissible limit. Samples should be collected as described in paragraph IV. A. Laboratories performing chemical analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of parathion to plus or minus 25%.
- C. METHODS: Methods meeting these accuracy requirements are available from the National Technical Information Service, U. S. Department of Commerce, Springfield, Virginia 22161 under

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the title "NIOSH Analytical Methods for Set T" (Order number XXXXXXXXXX).

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

V. MISCELLANEOUS PRECAUTIONS

- A. Store parathion in tightly closed containers in a well ventilated area.
- B. Use of supplied-air suits or other impervious coverings (such as acid suits) may be necessary to prevent skin absorption from parathion. Supplied-air suits should be selected, used, and maintained under the immediate supervision of persons knowledgeable in the limitations and potential life endangering characteristics of supplied-air suits.
- C. Employers should advise employees of all areas and operations where their exposure to parathion could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to parathion is likely to occur are: During its production and its use as an insecticide.

NOTE: The information contained in the following appendix for parathion is neither intended, by itself, to create any additional obligations not otherwise imposed, nor detract from any existing obligations. To the extent the information supplements this regulation for parathion, it is advisory in nature.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation; skin absorption; ingestion.

II. TOXICOLOGY

Parathion is an anticholinesterase agent; absorption may occur from inhalation of the vapor or mist, from skin absorption of the liquid, or from ingestion. Signs and symptoms of overexposure are caused by the inactivation of the enzyme cholinesterase, which results in the accumulation of acetylcholine at synapses in the nervous system and skeletal and smooth muscle secretory glands. The sequence of the development of systemic effects varies with the route of entry. The onset of signs and symptoms may occur promptly or may be delayed for up to 12 hours. After inhalation, respiratory and ocular effects are the first to appear, often within a few minutes after exposure. Respiratory effects include tightness in the chest and wheezing due to bronchoconstriction and excessive bronchial secretion; laryngeal spasms and excessive salivation may add to the respiratory distress; cyanosis may also occur. Ocular effects include miosis, aching in and behind the

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eyes (attributed to ciliary spasm), blurring of distant vision, tearing, rhinorrhea, and frontal headache. After ingestion, gastrointestinal effects, such as anorexia, nausea, vomiting, abdominal cramps, and diarrhea appear within 15 minutes to 2 hours. After skin absorption, localized sweating and muscular fasciculations in the immediate area occur usually within 15 minutes to 4 hours; skin absorption is somewhat greater at higher ambient temperatures, and is increased by the presence of dermatitis. With severe intoxication by all routes, an excess of acetylcholine at the neuromuscular junctions of skeletal muscle causes weakness aggravated by exertion, involuntary twitchings, fasciculations, and eventually paralysis; the most serious consequence is paralysis of the respiratory muscles. Effects on the central nervous system include giddiness, confusion, ataxia, slurred speech, Cheyne-Stokes respiration, convulsions, coma, and loss of reflexes. The blood pressure may fall to low levels, and cardiac irregularities including complete heart block may occur; these effects may sometimes be reversed by establishing adequate pulmonary ventilation. Complete symptomatic recovery usually occurs within 1 week; increased susceptibility to the effects of anticholinesterase agents persists for weeks after exposure. Daily exposure to concentrations which are insufficient to produce symptoms following a single exposure may result in the onset of symptoms. Continued daily exposure may be followed by increasingly severe effects. A few drops of technical parathion in the eyes of animals have produced lacrimation and moderate conjunctivitis. The minimum lethal oral dose of parathion for humans has been estimated to range from less than 10 mg up to 120 mg. In a study of 115 workers exposed to parathion under varying conditions, the majority excreted significant amounts of p-nitrophenol (a metabolite of parathion) in the urine, while only those with heavier exposures had a measurable decrease in blood cholinesterase.

III. SIGNS AND SYMPTOMS

Miosis, aching in and behind eyes, blurring of distant vision, tearing, rhinorrhea, frontal headache; tightness in the chest, wheezing, laryngeal spasm, excessive salivation, cyanosis; anorexia, nausea, vomiting, abdominal cramps, diarrhea; localized sweating; muscular fasciculations, weakness aggravated by exertion, involuntary twitchings, paralysis; giddiness, confusion, ataxia, slurred speech, Cheyne-Stokes respiration, convulsion, coma, loss of reflexes; low blood pressure, cardiac irregularities including complete heart block; skin and eye irritation from direct contact.

-IV. SPECIAL TESTS

Serial measurements of cholinesterase activity in plasma and erythrocytes are helpful in monitoring an individual for effects of chronic exposure. They are also helpful in confirming diagnosis of intoxication. Although these values show considerable variation in the normal population, they

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will usually be depressed well below the normal range before any symptoms due to systemic anticholinesterase intoxication are evident. Such values do not reflect the activities of the corresponding enzymes in the nervous system or other tissues. The presence of significant amounts of p-nitrophenol in the urine is an indication of absorption of parathion.

V. TREATMENT

Remove from exposure. Immediately flush eyes with water and wash skin with soap or mild detergent and water. If swallowed and the person is conscious, induce vomiting. Observe for convulsions and initiate appropriate treatment. The physician should become thoroughly familiar with the use of atropine sulfate and 2-PAM (and other cholinesterase reactivators) which are antidotes. In very severe cases, the order of treatment should be as follows: 1) Artificial resuscitation, if required; 2) Atropine sulfate, 2 to 4 mg (1/30 to 1/15 grain) intravenously. Repeat at 5 to 10 minute intervals until signs of atropinization appear (dry, flushed skin and tachycardia as high as 140 per minute); 3) 2-PAM, slowly, intravenously, 1 g for adults; 4) Symptomatic treatment. In the more usual case, proceed as follows: 1) Atropine sulfate, 1 to 2 mg (1/60 to 1/30 grain), if symptoms appear. If excessive secretions occur, keep the patient fully atropinized. Give atropine sulfate every hour up to 25 to 50 mg in a day; 2) 2-PAM, slowly, intravenously, 1 g for adults, if the patient fails to respond satisfactorily to atropine sulfate. Neither atropine nor 2-PAM should be taken by workers as a prophylactic measure.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of parathion are caused by its anticholinesterase properties. In occupational cases, illness is frequently delayed several hours. Relatively incapacitating symptoms of nausea, cramps, discomfort in the chest, and muscular twitchings often follow initial giddiness, blurred vision, and headache only after a period of 2 to 8 hours. Miosis may appear late and mydriasis may actually be present as a reaction to the discomfort and apprehension associated with poisoning. Skin absorption is an important route of entry. It is important that the physician become familiar with plant operating conditions in which exposure to parathion 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

The following medical procedures must be made available to each employee who is exposed to parathion:

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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. Persons with a history of reduced pulmonary function, convulsive disorders, or recent exposure to anticholinesterase agents would be expected to be at increased risk from exposure. Examination of the respiratory system, nervous system, cardiovascular system, eyes, and attention to the cholinesterase levels in the blood should be stressed. The skin should be examined for evidence of chronic disorder.
2. Cholinesterase determination -- Parathion causes depressed levels of activity of cholinesterase in the serum and erythrocytes. The cholinesterase activity in the serum and erythrocytes shall be determined by using medically acceptable biochemical tests prior to any new period of exposure.

C. PERIODIC EXAMINATIONS

The above medical examinations are to be repeated on an annual basis, with the exception of the cholinesterase determination which shall be performed quarterly or at anytime overexposure is suspected or signs or symptoms of toxicity occur.

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Parathion," Documentation of the Threshold Limit Values for Substances in Workroom Air, (3d ed., 2d printing), Cincinnati, 1974, pp. 195-196.
2. Hayes, W.J., Jr.: Clinical Handbook on Economic Poisons, Emergency Information for Treating Poisoning, U.S. Public Health Service Publication No. 476, U.S. Government Printing Office, Washington, D.C., 1963, pp. 12-23, 35-37.
3. Goodman, Louis S. and Alfred Gilman: The Pharmacological Basis of Therapeutics (5d ed.), The Macmillan Publishing Company, New York, 1975, pp. 456-466.
4. Koelle, George B., Ed.: Handbuch der Experimentellen Pharmakologie, Vol. 15 - Cholinesterases and Anticholinesterase Agents, Springer-Verlag, Berlin, 1963, pp. 989-1027.
5. Hygienic Guide Series: "Parathion," American Industrial Hygiene Association Journal, 30:308-312, 1969.
6. Patty, Frank A.: Industrial Hygiene and Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1935-1940, 1949-1951.

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7. Arterberry, J.D., et al: "Exposure to Parathion - Measurement by Blood Cholinesterase Level and Urinary p-Nitrophenol Excretion," Archives of Environmental Health, 3:476-485, 1961.

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REFERENCES AND SOURCES

PARATHION

1910.1000

- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Gleason, "Clinical Toxicology of Commercial Products," third edition; Grant, "Toxicology of the Eye;" Spector, "Handbook of Toxicology;" International Labour Office, "Encyclopedia of Occupational Health and Safety"
- Skin: American Industrial Hygiene Association, "Hygienic Guide Series;" Gleason, "Clinical Toxicology of Commercial Products," third edition; Spector, "Handbook of Toxicology;" Stecher, "The Merck Index," eighth edition; International Labour Office, "Encyclopedia of Occupational Health and Safety;" Sax, "Dangerous Properties of Industrial Materials;" Christensen, "NIOSH Toxic Substances List;" Spencer, "Guide to the Chemicals Used in Crop Protection," sixth edition
- Ingestion: American Industrial Hygiene Association, "Hygienic Guide Series;" Gleason, "Clinical Toxicology of Commercial Products," third edition; Commonwealth of Pennsylvania, "Hygienic Information Guide," No. 27; Spector, "Handbook of Toxicology;" Christensen, "NIOSH Toxic Substances List"

COMMENTS

Eye - Classification: 1

Output statement numbers: 9, 13

Exceptions: None

Gleason notes that "as little as one drop of concentrated material represents a very real danger to life if splashed in the eye . . . an ocular exposure with liquid parathion is always manifested by prompt miosis and other ocular disturbances." Gleason reports symptoms of "primary ocular exposure" as "blurring or dimness of vision, miosis (with fixed pinpoint pupils), tearing, ciliary muscle spasm, loss of accommodation, and ocular pain."

Spector reports "the eye is a particularly sensitive avenue (LD absorbed (with death in 3 minutes) rabbit)."

Grant says the material is "an inhibitor of cholinesterase and is highly toxic. Absorption from contact with eyes . . . , causes miosis and spasms of accommodation for near, which may be accompanied by aching pain about the eyes and blurred vision for distant objects."

According to the ILO, "the poison . . . is easily absorbed through the . . . eye. Symptoms most often appear in this order: headaches, fatigue, giddiness, nausea, sweating, blurred vision, tightness in the chest, abdominal cramps, vomiting and diarrhoea. In more advanced poisoning . . . pulmonary oedema and respiratory failure follow."

The material is concluded to clearly warrant a classification of 1.

Skin - Classification: 1

Output statement numbers: 1, 5a, 6, 8a, 14g, 14i, 15, 20a

Exceptions: See below

The AINA regards the severity of hazard as "high" for this

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substance, and says the material may enter the body by "absorption through the intact skin." They further note that the material "inactivates cholinesterase enzyme in the central nervous system and produces symptoms similar to those from chemical warfare agents . . . to which parathion is related . . ."

Gleason says that "absorption to a dangerous degree can occur through any portal including the intact skin . . .," the greatest number of "accidents involving parathion are ascribed to dermal exposure." Gleason further reports, "although the inhibition of cholinesterase appears to be partially reversible for several hours after an acute exposure, there is a progressive and irreversible inactivation of enzymes following repeated exposures or prolonged contact . . . whatever the portal of entry, severe respiratory distress eventually appears in major intoxications."

Spector reports the material a hazard by "dermal contact," and is especially hazardous because there is "little warning of skin exposure" since "parathion is virtually non-irritant. Death has followed splashing of skin or clothing with the technical liquid in amounts insufficient to drench, or lead the victim to bathe or change clothes."

Stecher lists the most severe acute symptoms as "convulsions, coma" and "respiratory failure" and states that the "effects are cumulative." The ILO further adds that "chronic exposure to parathion may be cumulative in the sense that repeated exposures closely following each other can reduce cholinesterase faster than it can be regenerated to the point where a very small exposure can precipitate acute poisoning."

According to Sax, "death has followed splashing of the body and clothing of one worker with technical parathion (approximately 95 percent pure). The amount was sufficiently small that the worker was not soaked . . . Two operators have died after rather extensive skin contact with agricultural sprays."

Christensen lists the skin LD50 for the rat as 7 mg/kg, while Spencer gives the acute dermal LD50 for male rats as 21 mg/kg. Spector lists the rabbit cutaneous LD50 as 870 mg/kg, 420 mg/kg and 40 - 50 mg/kg for the pure substance in a corn oil solution.

Pure parathion has a melting point of 43 degrees F. The technical grade produce has one of 32 degrees F. The flash point of the compound is greater than 270 degrees F. It is 0.00002% soluble in water and has a vapor pressure of 0.00004 mm Hg at 20 degrees C.

A classification of 1 is clearly warranted for this compound. Statements 5a and 15 are used regardless of the fact the substance is a liquid at room temperature because of its extreme toxicity and its very low vapor pressure.

Ingestion - Classification: 1

Output statement numbers: 5a, 19, 20a

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Exceptions: None

The AIHA reports that "parathion inactivates cholinesterase enzyme in the central nervous system and produces symptoms similar to those from chemical warfare agents . . . they include unsteadiness, blurred vision, feeling of tightness in chest . . . and difficulty in breathing." Gleason notes that "death primarily due to respiratory arrest arising from failure of the respiratory center, paralysis of respiratory muscles, intense bronchoconstriction, or all three."

According to Hygienic Information Guide No. 27, "parathion is a highly toxic substance which acts on the central nervous system by interference with normal nerve impulses. . . , it is rated as a highly toxic material because a small absorbed quantity (0.3 grams) is fatal."

Gleason says the "absorption to a dangerous degree can occur through any portal . . . The probable lethal dose in man is best inferred from animal experimentation. On this basis, 10 to 20 mg is an estimate of the minimal oral dose which is acutely lethal to an adult, whereas the mean lethal dose is probably 300 mg (4 mg/kg)."

Spector says that "parathion is not cumulative in the strict sense. No storage in the body, little, if any, tissue damage. However, parathion exposure lowers choline esterase levels; small, repeated doses are more or less additive, and the organism remains relatively susceptible to low dosages and brief exposures until choline esterase is regenerated . . . In one case 120 mg were swallowed; paralysis came so swiftly that the victim proved unable to take advantage of antidotes near at hand."

Christensen lists the LD50 for the rat as 7 mg/kg while Spector gives the oral LD50 for the mouse at 25 mg/kg (in cellosolve plus water), for the guinea pig as 32 mg/kg (as an ethanol solution) and for man, the LD is given as about 20 mg/man (the pure substance in a corn oil solution).

A classification of 1 is clearly warranted for this substance.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1975 (NFPA)

Monsanto Co., Technical Bulletin No. AG-16, "Parathion, Methyl Parathion," and Material Safety Data Sheet (Mons)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 11, p. 700 (K-O)

Sources of data items used:

- | | | | |
|----|----|----|------------------------|
| 1. | A. | 1. | Synonyms: Mons |
| | | 2. | Formula: NFPA-49, Mons |
| | | 3. | Molecular weight: Mons |
| | B. | 1. | Boiling point: K-O |
| | | 2. | Specific gravity: Mons |

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- 3. Vapor density: Not applicable
- 4. Melting point: K-O, Mons
- 5. Vapor pressure: K-O
- 6. Solubility in water: K-O
- 7. Evaporation rate: Not applicable
- 8. Appearance and odor: NFPA-49, Mons, K-O
- II. A. 1. Flash point: Not applicable
- 2. Autoignition temperature: Data not available
- 3. Flammable limits: Not applicable
- 4. Extinguishing media: NFPA-49, Mons
- 5. Special fire fighting procedures: NFPA-49
- 6. Unusual fire and explosion hazards: NFPA-49, Mons
- B. 1. Conditions contributing to instability: NFPA-491M
- 2. Incompatibilities: ADL
- 3. Hazardous decomposition products: NFPA-49
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: NFPA-49, Mons
- C. Waste disposal method: Mons
- V. Miscellaneous precautions: NFPA-49, Mons

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

Batchelor, Gordon S., Walker, Kenneth C., "Health Hazards Involved in Use of Parathion in Fruit Orchards of North Central Washington," A.M.A. Archives of Industrial Hygiene, 10:6, p. 522 - 528, Dec. 1954 (Batchelor)

"EPA Compendium of Registered Pesticides," Environmental Protection Agency, vol. III, part 3, 1972 (EPA)

International Labour Office, "Encyclopedia of Occupational Health and Safety," McGraw-Hill Book Company, New York, 1971 (ILO)

"Parathion," Chemical Data Sheet No. 32, Massachusetts Department of Labor and Industries, Division of Occupational Hygiene, No. 1031, March 1972 (Mass)

"Parathion," Hazard Process Index, Hazard Entry No. 147, NIOSH HSM-99-73-62 (HPI)

"Parathion," Hygienic Guide Series, American Industrial Hygiene Association, 1969 (Hygienic Guide)

Patty, Frank, "Industrial Hygiene and Toxicology," vol. 2, second revised edition, Interscience Publishers, New York, 1963 (Patty)

Simpson, G. R., Sydney and Beck, A., "Exposure to Parathion," Archives of Environmental Health, vol. II, p. 784 - 786, December 1965 (Simpson)

"Some Interesting Field Studies for Control of Health Hazards," New York State Department of Labor, Division of Industrial Hygiene and Safety Standards, 30:1, 1950 (New York)

Spector, W. S. (vol. I, II), Negherbon, W. O. (vol. III), Grebe, R. M. (vol. IV), and Dittmer, D. S. (vol. V) - editors, "Handbook of Toxicology," Saunders, Philadelphia, 1956 - 1959 (Spector)

-Spencer, E. Y., "Guide to the Chemicals Used in Crop Protection," sixth edition, publication 1093, Research Branch Agriculture Canada, 1973 (Spencer)

References for Specific Use/Exposure

- 1. Spector, Hygienic Guide, New York, Spencer, ILO, Batchelor, Mass

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2. Hygienic Guide, HPI, ILO, Patty, EPA, Batchelor, Simpson, Massachusetts
3. Batchelor, ILO, Spencer, New York, Hygienic Guide, HPI
4. ILO, Mass, Batchelor

References for Specific Control Methods

1. Batchelor, Mass, New York, Hygienic Guide, ILO
2. Batchelor, Simpson, Mass, Hygienic Guide, ILO
3. ILO, Hygienic Guide, New York, Batchelor
4. ILO, Batchelor, Mass

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Parathion

D. O. L. Standard: 0.1 mg/M3

WARNING PROPERTIES:

Odor Threshold: The odor threshold of parathion is 0.04ppm
(ASTM Bulletin, JAWWA, 57:1016 (1965)).

Eye Irritation Level: The AIHA Hygienic Guides state that "a few drops of technical parathion in animals has produced immediate blinking, lacrimation, and moderate conjunctivitis. Pupil constriction was also observed, with a return to normal size and reaction the following day. Eye contact with 1% aqueous suspensions of 15% wettable powders did not show evidence of irritation or other obvious reaction." For the purposes of this standard, half-facepiece respirators are permitted unless eye irritation occurs. If eye irritation occurs, a full facepiece respirator must be worn.

Evaluation of Warning Properties: Since the odor threshold of parathion is so low, parathion is treated as a material with good warning properties. Gas sorbent respiratory equipment is permitted.

IDLH: 20 mg/M3

Basis for IDLH Value: There are no useful acute inhalation toxicity data available upon which to base the IDLH concentration for parathion. If the IDLH were estimated from the statement in the Hygienic Guides that "the minimum lethal oral dose for humans has been estimated as ranging from less than 10 mg to 120 mg," an IDLH of 5 mg/M3 would be chosen. This appears to be far too conservative, however, since the Documentation of TLV's notes that workers regularly exposed to 2 - 15 mg/M3, with an average concentration of 8 mg/M3, exhibited only a 15% decrease in cholinesterase levels. The IDLH (20 mg/M3), therefore, has been estimated from the oral LD50 of 3 mg female rats, given in the Documentation.

Other Toxicological Information: The AIHA Hygienic Guides state that "pharmacologically, parathion inactivates the cholinesterase enzymes in the central nervous system and produces symptoms of intense cholinergic stimulation. The rapidity of the onset of the earliest symptoms depends upon the severity of exposure. Depending on the route of entry and the size of the dose, the time of onset may vary from a few minutes to five hours following an acute exposure. Symptoms of parathion exposure include unsteadiness, headache, blurred vision, feeling of tightness in chest, nausea, sweating, general weakness and difficulty in breathing Because of low vapor pressure and low volatility, parathion is not very hazardous by vapor inhalation at ordinary temperatures. Saturated air at 25 C has a parathion concentration equal to 0.039 ppm Hazardous toxic effects may follow uncontrolled exposure and inhalation of sprays or dusts of parathion formulations." Concerning

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the atmospheric concentration immediately hazardous to life, the Guides state that "the minimum lethal inhalation dose is not known. However, it would be prudent to remember that the minimum lethal oral dose for humans has been estimated as ranging from less than 10 mg to 120 mg."

The Documentation of TLV's states that "parathion has an acute oral LD50 of 3 mg/kg for female rats and 6 mg/kg for male rats. Brown and Bush in the United States found parathion in a concentration range of 0.1 - 0.8 mg/M3 in a processing plant. Cholinesterase determinations on blood from exposed workers showed decreased activity. Barnes found that some factory workers manufacturing parathion had slight but statistically lowered cholinesterase levels, but did not measure parathion concentrations. American Cyanamid Company investigators found levels of parathion in California orchards up to 0.3 mg/M3 during spraying. They performed no cholinesterase determinations. Kay and co-workers measured both air concentrations of parathion at the human breathing zone in orchards and the cholinesterase levels of the workers engaged in the spraying. In this investigation workers had been in contact with parathion for periods of from two to five days on five occasions during a period of two months. No precautions were taken, other than to stay up-wind from the spray. Levels of 2 to 15 mg/M3 of parathion were found in the air. Cholinesterase levels of workers were decreased about 15% below controls by the end of the season. It would appear that marginal exposure had occurred in this instance. An estimate of the average exposure received cannot be more than approximate; however, if an average exposure of about 8 mg/M3 is assumed on working days and that spraying was done every fourth day, the average daily exposure was not more than 2.0 mg/M3 for a period of two months.

"Based on these calculations, 2 mg/M3 would appear to be an excessive exposure. From the work of Brown and Bush 0.5 mg/M3 appears excessive. It is concluded that 0.1 mg/M3 provides the best estimate for a threshold limit from available data . . .

"Edson found that doses of 1.47 mg/man/day produced no effect in volunteers, while a dosage of 5.46 produced moderate depression of blood cholinesterase. In corresponding studies in rats, Edson found that rats tolerated for 84 days a dosage corresponding to 0.42 mg/man/day, but showed a 46% fall in red blood cell cholinesterase when given a dosage equivalent to 4.2 mg/man/day.

"Parathion is one of the most toxic and also one of the most widely used of the organic phosphate insecticides. Nevertheless the tremendous number of cases of occupational and other intoxication reported from parathion appear out of proportion in comparison with those caused by similar pesticides, even when these factors are taken into consideration. Hartwell et al. found a greater depression of cholinesterase activity, for a given level of p-nitrophenol in urine, when parathion was absorbed by inhalation than when it was taken in through the skin. They, therefore, considered it more toxic by inhalation than by skin absorption."

The NIOSH Toxic Substances List gives a rat, skin penetration LD50 of 7 mg/kg.

VAPOR PRESSURE AT 20 C: 0.00004 mm Hg

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SATURATED CONCENTRATION AT 20 C: 0.053 ppm or 0.63 mg/M3

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USE/EXPOSURE AND CONTROL DOCUMENT
PARATHION

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of mist, fume, dust and skin contact with liquid and solid during formulation (mixing, dilution, wetting) for use as a pesticide (insecticide)	A,D	Process enclosure; personal protective equipment (gloves, goggles, respiratory protective devices); good personal hygiene practice
2.	Inhalation of mist, fume, dust and skin contact with liquid and solid (spray, wet powder, dust, granule, aerosol, emulsified concentrate) during application (spraying, dusting, pyrotechnic preparation (smoke)) for use as a pesticide (insecticide) on agriculture crops, vegetables, ornamentals and agriculture premises	A,D	Personal protective equipment (goggles, gloves, respiratory protective devices); good personal hygiene
3.	Inhalation of mist, fume, dust and skin contact with liquid and solid (emulsified concentrate, powder, granule, aerosol) during manufacturing (reaction of diethoxythiophosphorous chloride with sodium p-nitrophenate to produce ethyl parathion) for use as a pesticide (insecticide)	A,D	Process enclosure; general dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, gloves, protective clothing, respiratory protective devices); good personal hygiene practice
4.	Inhalation of mist, fume, dust, and skin contact with liquid and solid during processing (packaging, warehousing, transferring, transportation) for use as a pesticide (insecticide)	A,D	General dilution ventilation; local exhaust ventilation; personal protective equipment (goggles, gloves, protective clothing); good personal hygiene practice

A -- Inhalation

B -- Skin and eye contact resulting
in localized irritation

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

----- JES2 JOB STATISTICS -----

1,487 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

[illegible]