

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** METHYL IODIDE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for METHYL IODIDE

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 METHYL IODIDE.

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 methyl iodide in concentrations not in excess of 5 parts per million (ppm) (28 milligrams per cubic meter, mg/cu.m.) averaged over an eight-hour work shift, as stated in §§ 1910.93, Table G-1.

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

(b) Exposure determination and measurement.

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

(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 methyl iodide;

(ii) Any measurements of methyl iodide taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to methyl iodide; 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 methyl iodide 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 methyl iodide 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 methyl iodide 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 methyl iodide 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 methyl iodide above the permissible exposure. The employee shall also be notified of the corrective action being taken to reduce the exposure to at or below the permissible exposure.

(7) If two consecutive employee exposure measurements taken at least one week apart reveal that the employee is exposed to methyl iodide below the action level, the employer may terminate measurement for the employee.

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

(c) Methods of measurement.

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

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

Table 1

Concentration	Required Accuracy
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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 methyl iodide above the permissible exposure as defined in paragraph (a) (1) of this section.

(2) Employee exposures to airborne concentrations of methyl iodide shall be controlled to at or below the permissible exposure by engineering and work practice controls:

(i) Engineering and work practice controls shall be instituted to reduce exposures to at or below the permissible exposure, except to the extent that such controls are not technically feasible.

(ii) Wherever engineering and work practice controls are not sufficient to reduce exposures to at or below the permissible exposure, they shall nonetheless be used to reduce exposure to the lowest level feasible and shall be supplemented by respirators in accordance with paragraph (d) (4) of this section.

(3) Engineering controls: When mechanical ventilation is used to control exposure, measurements which demonstrate system effectiveness, for example, air velocity, static pressure, or air volume, shall be made at least every three months. Measurements of system effectiveness shall also be made within five days of any change in production, process, or control which might result in an increase in airborne concentrations of methyl iodide.

(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

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

(iv) In emergencies.

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

TABLE 2 RESPIRATORY PROTECTION FOR METHYL IODIDE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
50 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
250 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
800 ppm or less	A Type C supplied-air respirator operated in pressure-demand or other positive pressure mode.
Greater than 800 ppm or entry or escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode. A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any escape self-contained breathing apparatus. Any gas mask providing protection

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against organic vapors.

(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 methyl iodide.

(2) Methyl iodide 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 repeated or prolonged skin contact with liquid methyl iodide. Face shields shall comply with § 1910.133(a)(2), (a)(4), (a)(5), and (a)(6).

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

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

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

(2) Employers shall ensure that employees who handle liquid methyl iodide wash their hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

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

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

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

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

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

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

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

(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 methyl iodide or airborne concentrations of methyl iodide at or above the action level, without regard to the use of respirators, a medical examination which shall include as a minimum the following:

(i) A medical history and physical examination with emphasis on the central nervous system.

(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.

(4) The employer shall make available to each employee, exposed to methyl iodide 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).

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

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

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

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

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

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

(iv) The results of any employee's exposure measurement, if available;

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

(vi) Upon request of the physician, information from previous medical examination of the 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 could be directly or indirectly aggravated by exposure to methyl iodide or which could significantly interfere with the ability of the employee to follow recommended or required procedures for protecting himself from unusual or emergency exposure.

(B) Any recommended limitations on the employee's exposure to methyl iodide.

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

(ii) The written opinion shall not reveal medical information unrelated to exposure to methyl iodide.

(8) No employee shall be exposed to methyl iodide if such exposure could place the employee at increased risk of material impairment of his health. 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 methyl iodide.

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

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

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

(11) If an employee refuses any required medical examination, the employer shall inform the employee of the possible health consequences of such refusal and obtain a signed statement from the employee indicating that the employee understands the risks involved by refusing to be examined.

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

(k) Recordkeeping. (1) Exposure determination.

(i) The employer shall keep an accurate record of all determinations required to be made pursuant to paragraph (b)(1) of this section.

(ii) The record shall include the written determination required in paragraph (b)(2) of this section.

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

(2) Exposure measurements. (i) The employer shall keep an accurate record of all measurements taken to determine employee exposure to methyl iodide.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to methyl iodide 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

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the measurements demonstrating the effectiveness of such ventilation required by paragraph (d)(3) of this section.

(ii) This record shall include:

- (A) Date of measurement;
- (B) Type of measurement taken;
- (C) Result of measurement.

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

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

(ii) This record shall include:

- (A) Date of training;
- (B) Name and social security number of employee trained;
- (C) Content or scope of training provided.

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

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

(ii) This record shall include:

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

(B) Any employee medical complaints relative to exposure to methyl iodide;

(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 methyl iodide which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to methyl iodide 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:

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- (i) Receive an explanation of the measurement procedure.
- (ii) Visually observe all steps related to the measurement of the airborne concentration of methyl iodide 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 METHYL IODIDE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Methyl iodide
- B. Permissible Exposure: 5 parts of methyl iodide per million parts of air (ppm) or 28 milligrams of methyl iodide per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Colorless liquid which turns yellow, red and brown on exposure to light and moisture.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Methyl iodide can affect your body if you inhale it or if it comes in contact with your eyes or skin. It may also affect your body if you swallow it.
- B. Effects of Overexposure:
 - 1. Short-Term Exposure: Methyl iodide may cause nausea and vomiting, diarrhea, dizziness, slurred speech, visual disturbances, staggering, shaking, irritability, drowsiness, coma and death. It may irritate the eyes and lungs. Contact with the liquid may cause irritation and blistering of the skin.
 - 2. Long-Term Exposure: Prolonged overexposure to methyl iodide may cause skin irritation.
 - 3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect they are caused by exposure to methyl iodide.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If methyl iodide gets into your eyes, wash your eyes promptly 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 methyl iodide gets on your skin, immediately flush the contaminated skin using soap or mild detergent and water. If methyl iodide soaks through your clothing, remove the clothing immediately and flush the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.
- C. Breathing: If you or any other person breathes in large amounts of methyl iodide, move the exposed person to fresh air at once. If breathing has stopped, perform artificial respiration. Keep the

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affected person warm and at rest. Get medical attention as soon as possible.

- D. Swallowing: When methyl iodide 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 methyl iodide. 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 their use is required. If you can smell methyl iodide while wearing a respirator, the respirator is not working correctly; go immediately to fresh air. If you experience difficulty breathing while wearing a respirator, tell your employer.
- B. Protective Clothing: You must wear impervious clothing, gloves, face shield or other appropriate protective clothing to prevent repeated or prolonged skin contact with methyl iodide. Replace or repair impervious clothing that has developed leaks.
- C. Eye Protection: You must wear splash-proof safety goggles (cup-cover type dust and splash safety goggles) where eye contact to liquid methyl iodide may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Methyl iodide must be stored in tightly closed containers in a well ventilated area away from light, moisture, and strong oxidizers.
- B. You must immediately remove any non-impervious clothing that becomes contaminated with liquid methyl iodide and this clothing must not be reworn until the methyl iodide is removed from the clothing.
- C. If your skin becomes wet with liquid methyl iodide, you must immediately wash or shower using soap or mild detergent and water to remove the methyl iodide from your skin.
- D. You must not eat or smoke in areas where methyl iodide is handled, processed or stored.
- E. If you handle liquid methyl iodide, you must wash your hands thoroughly with soap or mild detergent and water before eating, smoking or using toilet facilities.

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- F. Ask your supervisor where methyl iodide 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 methyl iodide and to instruct you in the safe and correct use of protective equipment.
- B. Your employer is required to determine whether you are being overexposed to methyl iodide. You or your representative has the right to observe employee exposure measurements and to be informed of the results.
- C. Your employer is required to release your exposure determination and medical records to your physician upon written request from your physician.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR METHYL IODIDE

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: Iodomethane
 - 2. Formula: CH_3I
 - 3. Molecular weight: 142
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): 42.5 C (108 F)
 - 2. Specific gravity (water=1): 2.3
 - 3. Vapor density (air=1 at boiling point of methyl iodide): 4.9
 - 4. Melting point: -66 C (-87 F)
 - 5. Vapor pressure at 20 C (68 F): 375 mm Hg
 - 6. Solubility in water, % by weight at 20 C (68 F): 2
 - 7. Evaporation rate (butyl acetate=1): data not available
 - 8. Appearance and odor: Colorless liquid which turns yellow, red, and brown on exposure to light and moisture.
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
 - A. Fire
 - 1. Not combustible
 - B. Reactivity
 - 1. Conditions contributing to instability: Heat, light, and moisture.
 - 2. Incompatibilities: Reacts with strong oxidizing agents
 - 3. Hazardous decomposition products: Toxic gases and vapors (such as iodine and hydrogen iodide) may be released when methyl iodide decomposes.
 - 4. Special precautions: None
- III. SPILL, LEAK AND DISPOSAL PROCEDURES
 - A. If methyl iodide 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 similar material.
 - B. Persons not wearing protective equipment should be restricted from areas of spills or leaks until cleanup has been completed.
- IV. MONITORING AND MEASUREMENT PROCEDURES
 - A. Exposure Above the Action Level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single 8-hour sample or two (2) 4-hour samples. Several short term interval samples (up to 30 minutes) may also be used to determine average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by

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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 methyl iodide to plus or minus 35%.

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

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

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

V. MISCELLANEOUS PRECAUTIONS

A. Store methyl iodide in tightly closed containers in a well-ventilated area.

B. Employers should advise employees of all areas and operations where exposure to methyl iodide could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to methyl iodide is likely to occur are: during its use as an intermediate in the formulation of pharmaceuticals; its use in laboratory experiments; its use as an insect fumigant and during production.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Methyl iodide vapor is an acute neurotoxin and possible pulmonary irritant. In mice, the LC50 for 57 minutes exposure was 900 ppm; the minimum fatal dose with 24 hour exposure was 75 ppm. A chemical worker accidentally exposed to the vapor developed giddiness, diarrhea, sleepiness and irritability, with recovery in a week; when re-exposed 3 months later he experienced drowsiness, vomiting, pallor, incoordination, slurred speech, muscular twitching, oliguria, coma and death. At autopsy there was bronchopneumonia and pulmonary hemorrhages, with accumulation of combined iodine in the brain. Experimental application of the liquid to human skin produced a stinging sensation and slight reddening in 10 minutes; after 6 hours contact there was spreading erythema with later formation of vesicles. One report mentions the production of sarcomas in 15 of 24 rats of BD strain arising from the subcutaneous injection of methyl iodide in an oil solution, but the report is fragmentary.

III. SIGNS AND SYMPTOMS

Nausea, vomiting; vertigo, ataxia; slurred speech, drowsiness; dermatitis; may cause eye irritation.

IV. SPECIAL TESTS

Urinary iodide levels may be an indication of exposure.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Methyl iodide is highly toxic, causing pulmonary and central nervous system effects. It is important that the physician becomes familiar with plant operating conditions in which exposure to methyl iodide 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. If overexposed, consideration should be given to hospitalization and observation for possible delayed onset of pulmonary edema.

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B. PREPLACEMENT

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

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 the central nervous system should be stressed. The skin should be examined for evidence of acute or chronic effects.

C. PERIODIC EXAMINATIONS

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

References

References

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3. von Oettingen, W. F.: The Halogenated Aliphatic, Olefinic, Cyclic, Aromatic, and Halogenated Insecticides, Their Toxicity and Potential Dangers, U.S. Public Health Service Publication No. 414, U.S. Government Printing Office, Washington, D.C., 1955, pp. 30-32.
4. Preussman, R: "Direct Alkylating Agents as Carcinogens," Food and Cosmetics Toxicology:576-577, 1968.

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REFERENCES AND SOURCES
METHYL IODIDE

1910.93

- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Buckell, M., "The Toxicity of Methyl Iodide: I.A. Preliminary Survey," British J. of Industrial Med., 7:122, 1950; and Dixon, M., "Reactions of Lachrymators with Enzymes and Proteins," Biochemical Society Symposia, Vol. 2
- Skin: Buckell, M., "The Toxicity of Methyl Iodide: I.A. Preliminary Survey," Brit. J. Indus. Med., 7:122, 1950; Sax, "Dangerous Properties of Ind. Materials"; PHS-149, "Survey of Compounds which have been Tested for Carcinogenic Activity"; NIOSH Toxic Substances List; Preussman, R., "Direct Alkylating Agents as Carcinogens," Food and Cosmetic Toxicology, Vol. 6; and Documentation in Support of TLV's.
- Ingestion: Sax, "Dangerous Properties of Industrial Materials"; Patty, "Ind. Hyg. and Tox.," and RSA Corp. MSDS

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

There are no specifics in the literature as to the effects of eye contact with the liquid. Buckell reports that mice exposed to vapor concentrations of 25 mg/l showed running of the eyes within a short time. This is consistent with Dixon's report that ethyl iodide is a powerful lacrimator.

Skin - Classification: 1 and 2

Output statement numbers: 2, 14g, 16i, and 20a

Exceptions: Special combination selected because of effects detailed below. 16i modified to include cleansing agent and to require immediate working. Statement 7 deleted because of high vapor pressure.

Its evaporation rate is high. It has been proposed for use as a fire extinguishant. Buckell (referred to in Patty) reports that methyl iodide can produce vesicular burns if closely applied to the skin. A soaked pad applied to a human forearm for 10 minutes produced a stinging sensation and a slight reddening of the skin which almost subsided in half an hour. Six hours later, however, a erythematous patch about five times the area of the original application had developed which included three small raised areas. Methyl iodid applied to the forearm and allowed to evaporate freely produced no effect. Buckell suggests that any clothing becoming contaminated should be removed immediately to prevent blistering. Sax lists it as a moderate acute local irritant as a highly toxic by skin absorption for acute exposures. It is noted as being a moderate systemic toxin in chronic exposures. Values of LD50 vary throughout the literature. Buckell uses both the figures

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.15 - .22 mg/kg and .15 - .22 g/kg for subcutaneous administration to rats; PHS-149 cites an LD50 of 830 mg/kg for similar administration to mice. The Toxic Substances List includes a figure of 110 mg/kg for the Subcutaneous LD50 in mice. The Documentation of TLV has the notation "skin" after the name of the chemical. Preussman reports that subcutaneous administration to rats has revealed that methyl iodide is carcinogenic. The substance is considered to have a hazard classification of 2 for direct skin contact but a classification of 1 for contacts where clothing becomes contaminated.

Ingestion - Classification: 1

Output statement numbers: 19, 20a

Exceptions: None

The MSDS cites 200 mg/kg as the oral rat LD50; Buckell reports both .15 - .22 mg/kg and .15 - .22 g/kg as oral rat LD50 values for fasted animals. Sax refers to methyl iodide as highly toxic systemically following acute ingestion and moderately toxic locally following acute ingestion. Chronic ingestion causes a moderate systemic reaction, according to Sax. The dosages required to produce serious effects are low enough to warrant a hazard classification of 1.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

R. S. A. Corp., Material Safety Data Sheet (RSA)

"Beilstein's Handbuch der Organischen Chemie," 1, 69 and supplements (Beil)

Sources of data items used:

- I. A. 1. Synonyms: RSA
- 2. Formula: RSA
- 3. Molecular weight: ADL
- B. 1. Boiling point: RSA
- 2. Specific gravity: RSA
- 3. Vapor density: RSA
- 4. Melting point: Beil
- 5. Vapor pressure: RSA
- 6. Solubility in water: RSA
- 7. Evaporation rate: data not available
- 8. Appearance and odor: RSA
- II. A. 1. Flash point: not applicable
- 2. Autoignition temperature: not applicable
- 3. Flammable limits: not applicable
- 4. Extinguishing media: not applicable
- 5. Special fire fighting procedures: RSA
- 6. Unusual fire and explosion hazards: none listed
- B. 1. Conditions contributing to instability: RSA
- 2. Incompatibilities: ADL
- 3. Hazardous decomposition products: RSA
- 4. Special precautions: none listed
- III. A. Steps if released or spilled: RSA; ADL

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- C. Waste disposal method: ADL
V. Miscellaneous precautions: RSA
VI. Common operations: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

- "Chemical Abstracts," American Chemical Society, Vol. 66 - 77, 1967 - 72 (CA)
International Labour Organization, "Encyclopedia of Occupational Health and Safety," Geneva, 1972 (ILO)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 1st edition, 1954 (Chem Tech)
Kirk, R. and Othmer, D., "Encyclopedia of Chemical Technology," Interscience Publishers, Division of John Wiley, 2nd edition, 1972 (K-O)
"Methyl Iodide," Material Safety Data Sheet, R. S. A., 1972 (MSDS)
"Merck Index of Chemicals and Drugs," Merck and Co., Inc., Rahway, New Jersey, 8th edition, 1968 (Merck)
Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience Publishers, 1962 (Patty)

References for Specific Use/Exposure

1. ILO, K-O
2. CA
3. Merck
4. ADL estimate, ILO
5. K-O, Merck
6. K-O
7. Chem Tech, Patty

References for Specific Control Methods

1. ILO, MSDS
2. ILO, MSDS
3. ILO, MSDS
4. ADL estimate, ILO, MSDS
5. ILO, MSDS
6. ILO, MSDS
7. ADL estimate, MSDS

RESPIRATOR TABLE JUSTIFICATION

According to Patty, methyl iodide is chiefly a depressant of the central nervous system. In addition, lung irritation appears to result from acute exposures.

Patty reports that in one investigation 87,693 ppm was fatal to mice in 10 minutes; 18,109 ppm was fatal in 30 minutes; 7,340 ppm in 60 minutes; 3670 - 5373 ppm in 2 - 2 1/2 hours of exposure; and 73.4 - 734 ppm in 24 hours.

Patty also cited an acute toxicity study in which the lethal concentration for rats from a 15-minute exposure was determined to be 3790 ppm. A 57-minute exposure of mice to 860 ppm resulted in mortality in half of the animals.

Deichman and Gerarde give a rat LC50 of 224 ppm (1.3 mg/l) for a 4-hour exposure.

A few fatal cases of industrial poisoning from methyl iodide are cited in the literature, but no specific information is given about the lethal concentrations.

WARNING PROPERTIES: Although methyl iodide is known to have a sweet ethereal odor, there are no quantitative data available on the

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odor threshold. Methyl iodide is treated as a material with poor warning properties.

EYE IRRITATION: According to Grant, concentrations of methyl iodide of 4300 - 14,620 ppm caused immediate irritation of the eyes and lacrimation in mice, but 860 ppm for ten minutes caused no irritation.

IDLH: Based upon the LC50 of 860 ppm for mice for a 57-minute exposure, an IDLH of 800 ppm is assumed for methyl iodide.

LFL: Methyl iodide is not flammable.

PERMISSIBLE EXPOSURE: 5 ppm.

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USE/EXPOSURE AND CONTROL DOCUMENT
METHYL IODIDE

Principal Route
of Entry

Currently Used
Control Methods

- | | Use/Exposure | Principal Route of Entry | Currently Used Control Methods |
|----|--|--------------------------|---|
| 1. | Inhalation of vapor and skin contact with liquid during use as a methylating agent in organic synthesis (special pharmaceuticals and organic intermediates for special synthesis) | A,B,D | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, apron, goggles) |
| 2. | Inhalation of vapor and skin contact with liquid during use in chemical and related laboratory research (as a catalyst, for special physical properties studies, reaction mechanism studies, synthesis of new compounds) | A,B,D | Process enclosure (depending on procedure); local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, apron, goggles) |
| 3. | Inhalation of vapor and skin contact with liquid during manufacture of methyl iodide (heating methyl alcohol and iodine with red phosphorous) | A,B,D | Process enclosure; local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, apron, goggles) |
| 4. | Inhalation of vapor and skin contact with liquid during cleaning and maintenance of storage vessels and during clean up of accidental spills | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (respirator, gloves, goggles, boots, aprons) |
| 5. | Inhalation of vapor and skin contact with liquid during use in analytical chemistry laboratories (test for pyridine, evaluating type of sulphur linkage in vulcanized rubber) | A,B,D | Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, apron, goggles) |
| 6. | Inhalation of vapor and skin contact with liquid during use in academic laboratory courses in organic chemistry | A,B,D | Process enclosure (depending on procedure), local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, apron, goggles) |

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|----|---|-------|--|
| 7. | Inhalation of vapor and skin contact with liquid during use as an insecticidal fumigant (scale insects, lady beetles, confused flour beetles) | A,B,D | Process enclosure (if possible), general dilution ventilation; personal protective equipment (respirator gloves, goggles, apron) |
|----|---|-------|--|

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