

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** ACETYLENE TETRABROMIDE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for ACETYLENE TETRABROMIDE

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 ACETYLENE TETRABROMIDE.

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 acetylene tetrabromide in concentrations not in excess of 1 part per million (ppm) (14 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 acetylene tetrabromide.

(b) Exposure determination and measurement.

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

(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 acetylene tetrabromide;

(ii) Any measurements of acetylene tetrabromide taken;

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

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

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

(c) Methods of measurement.

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

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

Table 1

Concentration

Required Accuracy

Above permissible exposure

$\pm 25\%$

At or below permissible exposure

and above the action level

$\pm 35\%$

At or below the action level

$\pm 50\%$

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

(2) Employee exposures to airborne concentrations of acetylene tetrabromide 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. (1) 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 acetylene tetrabromide.

(ii) In the design of open surface tank ventilation for the purposes of §1910.94 (d), operations involving acetylene tetrabromide shall be classified as B-4 at 70 degrees F.

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- (4) Compliance with the permissible exposure shall not be achieved the use of respirators except:
- (i) During the time period necessary to install or implement engineering or work practice controls; or
 - (ii) In work situations in which engineering and work practice controls are technically not feasible; or
 - (iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of acetylene tetrabromide to at or below the permissible exposure; or
 - (iv) For operations which require entry into tanks or closed vessels; or
 - (v) In emergencies.
- (5) Where respirators are needed and permitted under this paragraph to reduce employee exposure, the employer shall select and provide the appropriate respirator from Table 2 and shall ensure that the employee use the respirator provided.

TABLE 2 RESPIRATORY PROTECTION FOR ACETYLENE TETRABROMIDE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Vapor Concentration	
10 ppm or less	Any supplied-air respirator.
	Any self-contained breathing apparatus.
Greater than 10 ppm or entry and escape from unknown concentrations	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
	A combination respirator which includes a Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure or continuous-flow mode and an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive pressure mode.
Fire Fighting	Self-contained breathing apparatus with a full facepiece operated in pressure-demand or other positive pressure mode.
Escape	Any gas mask providing protection against organic vapors.
	Any escape self-contained breathing apparatus.

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(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 acetylene tetrabromide.

(2) Acetylene tetrabromide shall be stored so as not to come in contact with strong caustics and chemically active metals.

(f) Personal Protective Equipment. (1) Employers shall provide and ensure that employees use impervious clothing, gloves, face shields (eight-inch minimum) and other appropriate protective clothing necessary to prevent repeated or prolonged skin contact with liquid acetylene tetrabromide. 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 acetylene tetrabromide be removed promptly and not re worn until the acetylene tetrabromide is removed from the clothing.

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

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

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

(h) Sanitation. Employers shall ensure that employees whose skin becomes contaminated with liquid acetylene tetrabromide promptly wash or shower with soap or mild detergent and water to remove any acetylene tetrabromide from the skin.

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

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

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

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

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

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

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

(ii) A profile of liver function.

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

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

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

(4) The employer shall make available to each employee, exposed to acetylene tetrabromide in excess of the action level at 12 months from the date of the employee's first exposure, and at every 12 months of exposure in excess of the action level thereafter, a medical examination which must include the following:

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

(ii) Tests of liver function (see paragraph (j)(2)(ii) of this section).

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

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

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

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

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

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

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

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

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

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

(7)(i) The physician's written opinion shall be a signed statement by the examining physician specifically stating: (A) Whether the employee has any detected medical conditions which would place the employee at increased

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risk of material impairment of the employee's health from exposure to acetylene tetrabromide or would directly or indirectly aggravate any detected medical condition;

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

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

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

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

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

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

(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 acetylene tetrabromide.

(ii) This record shall include:

(A) The date of measurement;

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

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

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

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

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

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

(ii) This record shall include:

(A) Date of measurement;

(B) Type of measurement taken;

(C) Result of measurement.

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

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

(ii) This record shall include:

(A) Date of training;

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

(C) Content or scope of training provided.

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

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

(ii) The record shall include:

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

(B) Any employee medical complaints relative to exposure to acetylene tetrabromide;

(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.

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(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 acetylene tetrabromide which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to acetylene tetrabromide 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 acetylene tetrabromide 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 ACETYLENE TETRABROMIDE

I. SUBSTANCE IDENTIFICATION

- A. Substance: Acetylene tetrabromide
- B. Permissible Exposure: 1 part of acetylene tetrabromide per million parts of air (ppm) or 14 milligrams of acetylene tetrabromide per cubic meter of air (mg/cu m) averaged over an eight-hour work shift.
- C. Appearance and Odor: Pale yellow liquid with a pungent odor.

II. HEALTH HAZARD DATA

- A. Ways in Which the Chemical Affects Your Body: Acetylene tetrabromide can affect your body if you inhale it or if it comes in contact with your eyes. It may also affect your body if you swallow it.
- B. Effects of Overexposure:
 - 1. Short-Term Exposure: Acetylene tetrabromide may cause eye and nose irritation, headache, loss of appetite, nausea, and abdominal pain, kidney and liver damage with such symptoms as dark urine and yellow jaundice. Breathing high concentrations of this chemical might damage the lungs.
 - 2. Long-Term Exposure: Prolonged or repeated contact with acetylene tetrabromide might cause irritation of the skin.
 - 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 acetylene tetrabromide.

III. EMERGENCY FIRST AID PROCEDURES

- A. Eye Exposure: If acetylene tetrabromide gets into your eyes, wash your eyes immediately with large amounts of water, lifting the lower and upper lids occasionally. Get medical attention immediately. Contact lenses should not be worn when working with this chemical.
- B. Skin Exposure: If acetylene tetrabromide gets on your skin, flush the contaminated skin with water promptly. If acetylene tetrabromide soaks through your clothing, remove the clothing promptly and wash the skin with 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 acetylene tetrabromide, 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 immediately.

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- D. Swallowing: When acetylene tetrabromide has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the 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 acetylene tetrabromide. 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 acetylene tetrabromide 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 and other appropriate protective clothing to prevent repeated or prolonged skin contact with liquid acetylene tetrabromide. 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 with liquid acetylene tetrabromide may occur.

V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE

- A. Acetylene tetrabromide must be stored in tightly closed containers in a well ventilated area away from strong caustics, chemically active metals, hot iron, aluminum and zinc.
- B. You must promptly remove any non-impervious clothing that becomes contaminated with liquid acetylene tetrabromide and this clothing must not be reworn until the acetylene tetrabromide is removed from the clothing.
- C. If your skin becomes contaminated with liquid acetylene tetrabromide, you must promptly wash or shower using soap or mild detergent and water to remove the acetylene tetrabromide from your skin.

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- D. Ask your supervisor where acetylene tetrabromide 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 in this Substance Safety Data Sheet for acetylene tetrabromide. In addition, your employer must instruct you in the safe use of acetylene tetrabromide, emergency procedures, and the correct use of protective equipment.
- B. Your employer is required to determine whether you are being overexposed to acetylene tetrabromide. You or your representative have the right to observe employee exposure measurements and to record the results obtained. If your employer determines that you are being overexposed, he is required to inform you of the exposure and of the actions which are being taken to reduce your exposure.
- C. Your employer is required to keep records of exposure determinations, exposure measurements, and medical surveillance. Your employer is required to make records of exposure determinations and your exposure measurements available to you or your representative upon your request. Your employer is required to release your medical records to your physician upon your written request.

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APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR ACETYLENE TETRABROMIDE

- I. PHYSICAL AND CHEMICAL DATA
- A. Substance Identification
1. Synonyms: Tetrabromoethane; symmetrical tetrabromoethane
1,1,2,2-tetrabromoethane
 2. Formula: $\text{CHBr}_2\text{CHBr}_2$
 3. Molecular weight: 345.7
- B. Physical Data
1. Boiling point (760 mm Hg): 239 C (462 F)
 2. Specific gravity (Water = 1): 2.97
 3. Vapor density (air = 1 at boiling point of acetylene tetrabromide): 11.9
 4. Melting point: -1 C (30 F)
 5. Vapor pressure at 20 C (68 F): less than 0.1 mm Hg
 6. Solubility in water, % by weight at 20 C (68 F): 0.065
 7. Evaporation rate (butyl acetate = 1): data not available
 8. Appearance and odor: Pale yellow liquid with a pungent odor
- II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA
- A. Fire
1. Not combustible
- B. Reactivity
1. Conditions contributing to instability: Heat
 2. Incompatibilities: Reacts with chemically active metals or with strong caustics. In the presence of steam, contact with hot iron, aluminum and zinc may cause formation of toxic vapors.
 3. Hazardous decomposition products: Toxic gases and vapor (such as hydrogen bromide, carbonyl bromide, brominated solvents and carbon monoxide) may be released when acetylene tetrabromide decomposes.
 4. Special precautions: Acetylene tetrabromide will attack forms of plastics, rubber and coatings.
- III. SPILL, LEAK, AND DISPOSAL PROCEDURES
- A. If acetylene tetrabromide 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: Acetylene tetrabromide may be disposed of by absorbing in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

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IV. MONITORING AND MEASUREMENT PROCEDURES

- A. Exposure above the action level: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two (2) 4-hour samples. Several short time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the employee's breathing zone (air that would most nearly represent that inhaled by the employee). Sampling and analyses may be performed by instruments such as detector tubes certified by NIOSH under 42 CFR part 84. Portable direct-reading instruments, dosimeters, or gas and vapor adsorption tubes with subsequent chemical analyses. The method of measurement must determine the concentration of acetylene tetrabromide to plus or minus 35%.
- B. Exposure above the permissible exposure: The monitoring and measurements under this section should be essentially the same as described under paragraph (IV)(A). Laboratories performing chemical analysis should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of acetylene tetrabromide to plus or minus 25%.
- C. Methods: Methods meeting the above accuracy requirements are available from NIOSH.
- D. Qualified Persons: Since many of the duties relating to employee protection are dependent on the results of monitoring and measuring procedures, employers should assure that the evaluation of employee exposures is performed by a competent industrial hygienist or other technically qualified person.

V. MISCELLANEOUS PRECAUTIONS

- A. Store acetylene tetrabromide in tightly closed containers in a well ventilated area.
- B. Employers should advise employees of all areas and operations where exposure to acetylene tetrabromide could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to acetylene tetrabromide is likely to occur are: during its use as a gage fluid; as a heavy liquid in the separation of solids; as an immersion fluid in light microscopy; as a catalyst in the oxidation of p-xylene to terephthalic acid; as a flame retardant; and during its production.

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APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Acetylene tetrabromide vapor is severely hepatotoxic. Guinea pigs exposed for 90 minutes to vapors in a near-saturated atmosphere as low as 14 ppm, became comatose, seemed to recover, but died after several days. Some animals exposed at 4 ppm for 180 days showed slight fatty degeneration of the liver; at 1.1 ppm no adverse effects were noted. The liquid instilled in the rabbit eye caused slight to moderate pain, conjunctival irritation, and corneal injury which disappeared after 24 hours. When bandaged onto the shaved abdomen of the rabbit for 72 hours, moderate redness, edema, and blistering were observed. A chemist working with the substance for 7 1/2 hours with no local exhaust ventilation developed severe, nearly fatal, liver damage and was hospitalized for 9 weeks; his estimated exposure during most of the work shift prior to the onset of symptoms for most of the day was 1 to 2 ppm, although he had a single 10-minute period exposure to approximately 16 ppm. He complained first of headache, anorexia, and nausea within hours of the exposure, and within five days developed abdominal pain with bilirubinuria and a monocytosis of 17%. He apparently recovered. Other workers in the same laboratory complained only of slight eye and nose irritation, with headache and lassitude.

III. SIGNS AND SYMPTOMS

Eye and nose irritation; anorexia, nausea; severe headache; abdominal pain; jaundice and other signs of liver disease; monocytosis.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

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

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Most reported effects of acetylene tetrabromide are caused by its effects on the liver. It is important that the physician becomes familiar with plant operating conditions in which exposure to acetylene tetrabromide occurs. Those with skin disease may not

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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 acetylene tetrabromide:

1. A complete history and physical examination -- The purpose is to detect preexisting conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of liver should be stressed.
2. Liver function tests -- Acetylene tetrabromide may cause liver damage. A profile of liver function shall be obtained by utilizing a medically acceptable array of biochemical tests.

C. PERIODIC EXAMINATIONS

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

References

1. American Conference of Governmental Industrial Hygienists: "Tetrabromoethane (Acetylene Tetrabromide)," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 248.
2. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 1294-1296.
3. Hollingsworth, R. L., et al: "Toxicity of Acetylene Tetrabromide Determined on Experimental Animals," American Industrial Hygiene Association Journal, 24:28-35, 1963.
4. Van Haaften, A. B.: "Acute Tetrabromoethane (Acetylene Tetrabromide) Intoxication in Man," American Industrial Hygiene Association Journal, 30:251-256, 1969.

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REFERENCES AND SOURCES
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1910.93

- (d) Compliance - Open surface tank classification based on relative evaporation rate estimated as "nil" from guidelines in ANSI Z9.1. (Boiling point = 462 F.)
- (f) Personal Protective Equipment, and, (h) Sanitation
- Eye: Hollingsworth et al, "Toxicity of Acetylene Tetrabromide Determined on Experimental Animals;" AIHA Journal, 24:1, 1963
- Skin: Hollingsworth et al, "Toxicity of Acetylene Tetrabromide Determined on Experimental Animals;" AIHA Journal 24:1, 1963; Patty, "Industrial Hygiene and Toxicology;" Sax, "Dangerous Properties of Industrial Materials"
- Ingestion: Hollingsworth et al, "Toxicity of Acetylene Tetrabromide Determined on Experimental Animals;" AIHA Journal 24:1, 1963; Patty, "Industrial Hygiene and Toxicology;" Sax, "Dangerous Properties of Industrial Materials"

COMMENTS

Eye - Classification: 2

Output statement numbers: 10

Exceptions: None

Work by Hollingsworth et al on rabbit eyes showed that "Undiluted acetylene tetrabromide promptly caused slight to moderate pain, slight conjunctival irritation and very slight corneal injury which healed completely within 24 hours; washing one eye with water 30 seconds after contact reduced the degree of pain and conjunctival irritation observed and entirely eliminated the very slight corneal injury."

Skin - Classification: 2

Output statement numbers: 2, 7b, 17g, 17i

Exceptions: 20 deleted

Hollingsworth et al applied cotton pads moistened with acetylene tetrabromide to the shaven abdomen of rabbits for varying time periods with the following results: "very slight redness after 30 minutes, slight redness after one and four hours, and moderate redness and slight edema after 24 hours." Their paper continues "subsequently slight exfoliation appeared on all treated areas and disappeared completely within five days." When the substance was applied daily to the inner surface of the rabbit ear, five days per week for a total of 20 applications in 29 days, "no effects resulted from the first three applications but a slight to moderate exfoliation and loss of hair developed gradually thereafter (with healing) nearly complete within five days after the last application." Bandaging the substance to the shaven abdomen of rabbits for three successive 24-hour exposures produced moderate reddening, edema and blistering; eight days later, healing was complete. Patty states that "ordinary contact with the open skin does not result in any skin reaction if it is washed off in a reasonable period of time." Sax rates

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it as a moderately hazardous irritant in acute local exposures and slightly hazardous in chronic local exposures; it is only slightly hazardous systemically through skin absorption. Repeated and or prolonged exposures should be avoided. The substance is not combustible. Its vapor pressure at 20 C is less than 0.1 mm Hg. While its vapor pressure is very low, the effects of the substance are not considered sufficient to warrant specification of statement 20a. Since the permissible exposure is 1 ppm and the IDLH 10 ppm, statement 7b is included to minimize the risk of potentially dangerous airborne concentrations from occurring as a result of evaporation from improperly stored clothing wet with tetrabromide.

Ingestion - Classification: 0

Output statement numbers: None

Exceptions: None

Hollingsworth et al determined that a single dose of 0.6 g/kg allowed 100% survival and 1.6 g/kg established an LD100 in rats. An LD50 of 0.4 g/kg for rabbits and guinea pigs is listed in Patty. Sax rates it as a moderately hazardous substance in acute ingestion exposures. Long - term feeding studies would not appear to have been conducted with this substance.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

National Fire Protection Association, "Fire Protection Guide on Hazardous Materials," 5th edition, 1973 (NFPA)

Dow Chemical Co., "Dow Products and Services" (Dow)

Kirk-Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 3, p. 776 (K-O)

"Beilstein's Handbuch der Organischen Chemie," Vol. I, p. 94 and supplements (Beil)

Sources of data items used:

- I. A. 1. Synonyms: NFPA-325M
- 2. Formula: Dow
- 3. Molecular weight: Dow
- B. 1. Boiling point: Dow
- 2. Specific gravity: Dow; NFPA-325M
- 3. Vapor density: NFPA-325M
- 4. Melting point: Dow
- 5. Vapor pressure: Beil; CRC extrapolation
- 6. Solubility in water: Beil
- 7. Evaporation rate: data not available
- 8. Appearance and odor: Dow; NFPA-49
- II. A. 1. Flash point: NFPA-49
- B. 1. Conditions contributing to instability: NFPA-49; Beil
- 2. Incompatibilities: ADL
- 3. Hazardous decomposition products: ADL
- 4. Special precautions: ADL
- III. A. Steps if released or spilled: ADL
- C. Waste disposal method: ADL
- V. Miscellaneous precautions: NFPA-49

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VI. Common operations: K-0

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

"Chemical Abstracts," American Chemical Society, Vol. 66 - 79, 1967 - 1973 (CA)

Considine, D. M., "Chemical and Process Technology Encyclopedia," McGraw Hill Co., 1974 (Considine)

Hawley, G. G., "The Condensed Chemical Dictionary," Eighth Edition, Van Nostrand Reinhold Co., 1971 (Hawley)

Jolles, Z. E., "Bromine and Its Compounds," Academic Press, 1966 (Jolles)

Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience Publishers, 1962 (Patty)

Van Haaften, A. B., "Acute Tetrabromoethane Intoxication in Man," American Industrial Hygiene Assoc. Journal, 30 #3, p. 251 - 256 (1969) (Van Haaften)

References for Specific Use/Exposure

1. Considine, CA
2. CA, Jolles
3. Jolles, Van Haaften
4. Jolles
5. ADL estimate
6. Considine, Patty, Van Haaften
7. Hawley, Van Haaften

References for Specific Control Methods

1. Van Haaften
2. Van Haaften
3. ADL estimate, Van Haaften
4. Van Haaften

ADL estimate and Van Haaften were the references used for numbers 1 - 7.

RESPIRATOR TABLE DOCUMENTATION

PERMISSIBLE EXPOSURE: 1 ppm.

WARNING PROPERTIES: Even though acetylene tetrabromide is known to have a sweet, chloroformlike odor, Patty states that "the odor is not distinctive enough to be considered a good warning property." Since no quantitative data are available relating other warning properties to air concentrations of this substance, acetylene tetrabromide has been treated as a material with poor warning properties.

EYE IRRITATION: Acetylene tetrabromide vapor is not known to be an eye irritant.

LFL: Acetylene tetrabromide is not flammable.

IDLH: 10 ppm.

IDLH BASIS: Van Haaften reports that a chemist almost died who had been exposed to 1 - 2 ppm acetylene tetrabromide for 7 1/2 hours, with only a single 10 - minute exposure at 16 ppm. Assuming that 1 - 2 ppm would be a safe concentration to which the worker could be exposed for the 7 1/2 hours since the TLV is 1 ppm, the injury must have been produced by the 10 - minute exposure to 16 ppm and, therefore, the IDLH would be expected to fall between 2 and 15 ppm. For the purposes of this standard, an IDLH concentration of 10 ppm acetylene tetrabromide is assumed.

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SUMMARY OF TOXICOLOGY:

According to Patty, acetylene tetrabromide is a CNS depressant and can cause death from respiratory failure. In addition, it is a pulmonary irritant, a nephrotoxin, and a hepatotoxin.

Patty reports that rabbits survived a 2 1/2 - hour exposure to a saturated concentration of acetylene tetrabromide without deaths; rats survived the same concentration for 3 hours without deaths. One guinea pig out of 2, however, died following a 1-hour exposure to the saturated concentration, and all guinea pigs died following a 1 1/2 - hour exposure.

Patty states that "the theoretically saturated concentration should be about 79 ppm." Van Haaften, however, states that the vapor pressure of acetylene tetrabromide is .04 mm Hg at 23 deg. to 24 deg. C, which would yield a "theoretically saturated concentration" of approximately 53 ppm.

Van Haaften reports that a chemist who had been exposed to 1 - 2 ppm acetylene tetrabromide for 7 1/2 hours, with a single 10 - minute exposure to 16 ppm, almost died from liver damage. Van Haaften states that "it appears obvious that man does not react to TBE (acetylene tetrabromide) exposure as do rodents." This is an extremely toxic substance.

(Van Haaften, A. B., "American Industrial Hygienic Association Journal," 30:251, (1969))

VAPOR PRESSURE AT 20 C: less than 0.1 mm.

SATURATED AIR CONCENTRATION: less than 130 ppm.

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Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1. Inhalation of vapor during use as a catalyst or catalytic initiator (part of catalytic system in the oxidation of p-xylene to terephthalic acid - for synthetic fibers)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
2. Inhalation of vapor during use as an additive to polymers to render them flame proof, flame retardant or self-extinguishing (polystyrenes, polyurethanes, polyolefins)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
3. Inhalation of vapor and skin contact with liquid during use as a flotation agent (mineralogical laboratories and mineral processing plants for quantitative separation of ores into their constituent minerals - based on differences in specific gravity)	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (gloves, protective clothing)
4. Inhalation of vapor during the manufacture and processing of acetylene tetrabromide (addition of bromine to acetylene - product is purified by vacuum distillation)	A	Process enclosure; local exhaust ventilation; general dilution ventilation
5. Inhalation of vapor and skin contact with liquid during the cleaning and maintenance of storage vessels and during the cleanup of accidental spills	A,B	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices, gloves, goggles, protective clothing)
6. Inhalation of vapor and skin contact with liquid	A,B	Local exhaust ventilation; general dilution ventilation

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during the manufacture of
gauges and balancing
equipment using
acetylene tetrabromide
as a substitute for
mercury.

tion; personal protective
equipment (gloves)

7. Inhalation of vapor and
skin contact with liquid
during use in microscopy
as a refractive index
liquid

A,B

Local exhaust ventilation;
general dilution ventila-
tion; personal protective
equipment (gloves)

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

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

1,160 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

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