

NIOSH/OSHA STANDARDS COMPLETION PROGRAM

DRAFT TECHNICAL STANDARD AND
SUPPORTING DOCUMENTATION FOR

*** STIBINE ***

NIOSH/OSHA Draft Technical Standard
and Supporting Documentation for STIBINE

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 STIBINE.

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 stibine not in excess of 0.1 part per million (ppm) (0.5 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 stibine.

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

(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 stibine;

(ii) Any measurements of stibine taken;

(iii) Any employee complaints of symptoms which may be attributable to exposure to stibine; 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 stibine 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 stibine 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 stibine 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 stibine 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 stibine 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 stibine 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
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 stibine above the permissible exposure as defined in paragraph (a)(1) of this section.

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

(4) Compliance with the permissible exposure shall not be achieved by the use of respirators except:

(i) During the time period necessary to install or implement engineering or work practice controls; or

(ii) In work situations in which engineering and work practice controls are technically not feasible; or

(iii) To supplement engineering and work practice controls when such controls fail to reduce airborne concentrations of stibine 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.

TABLE 2 RESPIRATORY PROTECTION FOR STIBINE

CONDITION	PERMISSIBLE RESPIRATORY PROTECTION
Gas Concentration	
1 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
5 ppm or less	Any supplied-air respirator with a full facepiece, helmet or hood. Any self-contained breathing apparatus with a full facepiece.
40 ppm or less	A Type C supplied-air respirator operated in pressure - demand or other positive pressure or continuous-flow mode.
Greater than 40 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 stibine. Any escape self-contained breathing apparatus.

(6) Respirators shall be approved by the Mining Enforcement and Safety Administration (formerly Bureau of Mines) or by the National Institute for Occupational Safety and Health under the provisions of 30 CFR Part 11.

(7) The employer shall institute a respiratory protection program in accordance with § 1910.134(b), (d), (e), and (f).

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(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 stibine.

(2) Sources of ignition such as smoking or open flames are prohibited where stibine presents a fire or explosion hazard.

(f) Reserved.

(g) Spills and disposal. In the event that stibine is inadvertently released the employer shall immediately provide available ventilation.

(h) Reserved.

(i) Training and information. (1) Each employer who has a workplace in which stibine 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 stibine above the action level or employees or employees who work where a potentially hazardous release of stibine may occur, or employees who work where stibine presents a fire or explosion hazard, shall annually:

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

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

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

(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 airborne concentrations of stibine at or above the action level a medical examination which shall include the following:

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

(ii) A complete blood count to include at least red and white cell count, differential smear, hemoglobin and hematocrit.

(iii) Urinalysis to include specific gravity, albumin, glucose and a microscopic on centrifuged sediment.

(iv) 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 the blood tests, urinalysis, and liver-function tests.

(4) The employer shall make available to each employee, exposed to stibine 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:

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

(ii) A complete blood count to include at least red and white cell count, differential smear, hemoglobin and hematocrit.

(iii) Urinalysis to include specific gravity, albumin, glucose and a microscopic on centrifuged sediment.

(iv) A profile of liver function.

(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 the blood tests, urinalysis, and 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 stibine;

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

(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; 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 condition which would place the employee at increased risk of material impairment of the employee's health from exposure to stibine or would directly or indirectly aggravate any detected medical condition;

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

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

(8) No employee shall be exposed to airborne concentrations of stibine 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 stibine.

(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:

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(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) 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 stibine.

(ii) This record shall include:

(A) The date of measurement;

(B) Operations involving exposure to stibine 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.

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(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)(4) of this section and results of any tests conducted pursuant to paragraphs (j)(4) of this section;

(B) Any employee medical complaints relative to exposure to stibine;

(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 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) 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 stibine which is conducted pursuant to this section.

(2) When observation of measurement of employee exposure to stibine 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 stibine 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.

APPENDIX A

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SUBSTANCE SAFETY DATA SHEET
FOR STIBINE

- I. SUBSTANCE IDENTIFICATION
- A. Substance: Stibine
 - B. Permissible Exposure: 0.1 part of stibine per million parts of air (ppm) (0.5 milligram of stibine per cubic meter of air (mg/M3)) averaged over an eight-hour work shift.
 - C. Appearance and Odor: Colorless gas with a disagreeable odor, like hydrogen sulfide
- II. HEALTH HAZARD DATA
- A. Ways in which the chemical affects your body: Stibine can affect your body if you inhale it.
 - B. Effects of Overexposure:
 - 1. Short-term Exposure: Stibine may cause destruction of the red blood cells with headache, nausea, weakness, back and abdominal pain. It may later cause dark red urine, yellow jaundice, kidney damage and death. It may also cause lung irritation.
 - 2. Long-term Exposure: Not known
 - 3. Reporting Signs and Symptoms: You should inform your employer if you develop any signs or symptoms and suspect that they may be caused by exposure to stibine.
- III. EMERGENCY FIRST AID PROCEDURES
- A. Breathing: If you or any other person breathes in large amounts of stibine 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.
 - B. 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 stibine. 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 stibine 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.

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- B. Protective Clothing: Not applicable.
- C. Eye Protection: Not applicable.
- V. PRECAUTIONS FOR SAFE USE, HANDLING AND STORAGE
 - A. Stibine is a flammable gas.
 - B. Sources of ignition, such as smoking and open flames, are prohibited where ever stibine is handled, used or stored in a manner that could create a potential fire or explosion hazard.
 - C. Fire extinguishers, where provided, must be readily available and you should know where they are and how to operate them.
 - D. Ask your supervisor where stibine may be inadvertently released 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 stibine. In addition, your employer must instruct you in emergency procedures, and the correct use of protective equipment.
 - B. Your employer is required to determine whether you are being exposed to stibine. 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.

APPENDIX B

SUBSTANCE TECHNICAL GUIDELINES
FOR STIBINE

- I. PHYSICAL AND CHEMICAL DATA
 - A. Substance Identification
 - 1. Synonyms: Hydrogen antimonide; antimony trihydride
 - 2. Formula: SbH_3
 - 3. Molecular weight: 124.8
 - B. Physical Data
 - 1. Boiling point (760 mm Hg): -17 C (1 F)
 - 2. Specific gravity (water = 1): Liquid = 2.2 at boiling

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point

3. Vapor density (air = 1 at boiling point of stibine): 4.34
4. Melting point: -88 C (-126 F)
5. Vapor pressure at 20 C (68 F): Greater than 1 atmosphere
6. Solubility in water, % by weight at 20 C (68 F): 0.1
7. Evaporation rate (butyl acetate = 1): Not applicable
8. Appearance and odor: Colorless gas with a disagreeable odor like hydrogen sulfide

II. FIRE, EXPLOSION AND REACTIVITY HAZARD DATA

A. Fire

1. Flash point: Not applicable (Gas)
2. Autoignition temperature: Data not available
3. Flammable limits in air, % by volume: Data not available
4. Extinguishing media: Stop flow of gas.
5. Special fire-fighting procedures: None
6. Unusual fire and explosion hazards: Stibine is a flammable gas. All ignition sources must be controlled where stibine is produced in quantities that may be a potential fire or explosion hazard. However, it is unlikely that stibine will reach flammable concentrations in industrial operations.

B. Reactivity

1. Conditions contributing to instability: None
2. Incompatibilities: Reacts with acids, halogenated hydrocarbons, oxidizers and moisture.
3. Hazardous decomposition products: Antimony and hydrogen will be released when stibine decomposes.
4. Special precautions: None.

III. LEAK PROCEDURES

A. If stibine is leaked or released, the following steps should be taken:

1. Ventilate area of leak to disperse gas.
2. Control source of stibine formation.

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

IV. MONITORING AND MEASUREMENT PROCEDURES

A. EXPOSURE ABOVE THE ACTION LEVEL: Measurements taken for the purpose of determining employee exposure under this section are best taken such that the average 8-hour exposure may be determined from a single eight-hour sample or two 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 stibine to plus or minus 35%.

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- 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 analyses should be accredited in Industrial Hygiene Chemistry by the American Industrial Hygiene Association. The method of measurement must determine the concentration of stibine 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 the title "NIOSH Analytical Methods for Set O" (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. Employers should advise employees of all areas and operations where exposure to stibine could occur.

VI. COMMON OPERATIONS

Common operations in which exposure to stibine is likely to occur are: In lead storage battery rooms when overcharging occurs; during the reaction of antimony compounds with zinc or other reducing metals; during the treatment of certain drosses treated with acid; during the cleaning of storage tanks; and during the purification of antimony by electrolysis.

APPENDIX C - MEDICAL SURVEILLANCE GUIDELINES

I. ROUTE OF ENTRY

Inhalation.

II. TOXICOLOGY

Stibine gas is an extremely toxic hemolytic agent which causes injury to the liver and kidneys; it also may be a lung irritant. Guinea pigs exposed to 65 ppm for 1 hour developed hemoglobinuria followed within a few days by profound anemia. Cats and dogs exposed to 40-45 ppm for 1 hour developed pulmonary edema, and some died within 24 hours. Acute exposures to humans would be expected to cause rapid destruction of red blood cells, hemoglobinuria, anuria, jaundice, and death. Workers exposed to a mixture of gases of stibine, arsine, and hydrogen sulfide developed headache, weakness, nausea, abdominal and lumbar pain, hematuria, and profound anemia.

III. SIGNS AND SYMPTOMS

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Headache, weakness; nausea, abdominal pain; lumbar pain, hemoglobinuria, hematuria, hemolytic anemia; jaundice.

IV. SPECIAL TESTS

None in common usage.

V. TREATMENT

Remove from exposure. Consideration should be given to immediate hospitalization for symptomatic and supportive therapy as for other types of acute hemolytic anemia. An exchange transfusion should be considered and if renal failure develops, hemodialysis may be advisable. Dimercaprol (BAL) affords no protection against red cell destruction.

VI. SURVEILLANCE AND PREVENTIVE CONSIDERATIONS

A. GENERAL

Stibine is an extremely toxic hemolytic agent which may cause death usually from kidney failure. It is important that the physician become familiar with plant operating conditions in which exposure to stibine 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 stibine:

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 blood, liver, and kidneys should be stressed.
2. A complete blood count -- Stibine causes red blood cell hemolysis. A complete blood count must be performed, including a red cell count, a white cell count, a differential count of a stained smear, as well as hemoglobin and hematocrit.
3. Urinalysis -- Since kidney damage has been observed in humans exposed to stibine, a urinalysis shall be obtained to include at a minimum specific gravity, albumin, glucose and a microscopic on centrifuged sediment.
4. Liver function tests -- Since liver damage has been observed in humans exposed to stibine, a profile of liver function

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shall be obtained by using a medically acceptable array of biochemical tests.

C. PERIODIC EXAMINATIONS

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

VII. REFERENCES

1. American Conference of Governmental Industrial Hygienists: "Stibine," Documentation of the Threshold Limit Values for Substances in Workroom Air (3d ed., 2d printing), Cincinnati, 1974, p. 233.
2. Hygienic Guide Series: "Stibine," American Industrial Hygiene Association Journal, 21:529-530, 1960.
3. Patty, Frank A.: Industrial Hygiene and Toxicology, Vol. II - Toxicology (2d ed. revised), Interscience Publishing Company, New York, 1963, pp. 993-998.
4. Browning, Ethel: Toxicity of Industrial Metals (2d ed.), Butterworths, London, 1969, pp. 34-35.

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REFERENCES AND SOURCES

STIBINE

1910.93

(f) Personal Protective Equipment, and, (h) Sanitation

References: None

COMMENTS

General: Stibine is a poisonous gas with a boiling point of -17 degrees C and a melting point of -88 degrees C. There is no indication in the literature that stibine is used commercially, except perhaps as a fumigating agent. It is produced, sometimes by accident, when acid reacts with metal containing antimony as an impurity. Under these circumstances, it is concluded that none of the statements normally specified in the Personal Protective and Sanitation sections of the standard are appropriate or necessary.

SUBSTANCE TECHNICAL GUIDELINES

The references cited for this document include:

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

Kirk - Othmer, "Encyclopedia of Chemical Technology," 2nd edition, Vol. 2, p. 572 (K-O)

"Lange's Handbook of Chemistry," 11th edition (Lange)

"Gmelin's Handbuch der Inorganischen Chemie," 18B, 335 (Gmelin)

Sources of data items used:

- I. A. 1. Synonyms: K-O, NFPA-491M
2. Formula: K-O
3. Molecular weight: Lange
- B. 1. Boiling point: K-O
2. Specific gravity: Gmelin
3. Vapor density: K-O
4. Melting point: K-O
5. Vapor pressure: Not applicable
6. Solubility in water: Lange
7. Evaporation rate: Not applicable
8. Appearance and odor: K-O, Gmelin
- II. A. 1. Flash point: Not applicable
2. Autoignition temperature: Data not available
3. Flammable limits: Data not available
4. Extinguishing media: Not applicable
5. Special fire fighting procedures: Not applicable
6. Unusual fire and explosion hazards: Not applicable
- B. 1. Conditions contributing to instability: Gmelin
2. Incompatibilities: Explosive and Toxic Hazardous Materials, James Meidl
3. Hazardous decomposition products: None
4. Special precautions: None
- III. A. Steps if released or spilled: ADL
C. Waste disposal method: Not applicable
- V. Miscellaneous precautions: ADL

USE/EXPOSURE AND CONTROL DOCUMENT

References used in the preparation of this document include:

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- Browning, E., "Toxicity of Industrial Metals," 2nd edition, Butterworth and Co., Ltd., 1969 (Browning Metals)
- "Chemical Abstracts," American Chemical Society, Vol. 66 - 77, 1967 - 72 (CA)
- Halley, P. D., "Tank Cleaning Hazards and How to Control Them," Safety Maintenance, 137, p. 45 - 48, 1969, NIOSH 28586 (Halley)
- International Labour Office, "Encyclopedia of Occupational Health and Safety," 1972 (ILO)
- Nau, C. A., Anderson, W. and Cone, R. E., "Arsine, Stibine and Hydrogen Sulfide," Industrial Medicine, 13, p. 308 - 310, 1944, NIOSH 23649 (Nau)
- Patty, F. A., "Industrial Hygiene and Toxicology," Vol. II, Interscience Publishers, 1962 (Patty)
- "Stibine," Hazard Process Index, "Hazard Entry No. 174, NIOSH HSM-99-73-62 (HPI)
- "Stibine," Hygienic Guide Series, American Industrial Hygiene Association, December 1960 (Hygienic Guide)

References for Specific Use/Exposure

1. Hygienic Guide, Nau
2. HPI, Hygienic Guide
3. Browning Metals, HPI, ILO
4. HPI
5. Halley
6. CA

References for Specific Control Methods

1. HPI, Hygienic Guide
2. Patty
3. HPI, Hygienic Guide
4. HPI, Hygienic Guide
5. Hygienic Guide
6. HPI, Hygienic Guide

RESPIRATOR TABLE DOCUMENTATION

SUBSTANCE: Stibine

D. O. L. STANDARD: 0.1 ppm

WARNING PROPERTIES:

Odor Threshold: Patty states that "stibine has an extremely unpleasant odor that can serve as a warning; whether the threshold of odor detection is sufficiently low to prevent injury is uncertain." There is no quantitative information available, however, concerning the odor threshold of stibine.

Eye Irritation Level: Stibine is not known to be an eye irritant.

Evaluation of Warning Properties: Since there is no quantitative information relating warning properties to air concentrations of stibine, this gas is treated as a material with poor warning properties. Gas sorbent respiratory equipment is not permitted.

IDLH: 40 ppm

- Basis for IDLH Value: This IDLH is based upon the report in the AIHA Hygienic Guides that "exposure of dogs and cats for one hour to 40 - 45 ppm has proven dangerous."

Other Toxicological Information: The AIHA Hygienic Guides state that stibine is "extra hazardous for acute exposures. Exposure of experimental animals has indicated that tolerance to stibine is acquired

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quite rapidly; however, human data are lacking in this respect. Like arsine, (stibine) may cause rapid destruction of red blood cells, hemoglobinuria, jaundice, anuria, and death. Subjective effects are manifest as headache, nausea, and weakness. Early subjective signs are headache and nausea, lumbar and epigastric pain, followed by passage of dark red urine a few hours after exposure . . . (The) short exposure tolerance (is) not known. Exposure of dogs and cats for one hour to 40 - 45 ppm has proven dangerous."

The Documentation of TLV's points out that stibine is a lung irritant. "According to Flury and Zernik a 20 - minute exposure at 100 ppm caused delayed deaths of mice within a few days. Webster found that a single exposure of one hour at 40 - 45 ppm was dangerous to cats and dogs. Death occurred within 24 hours, with pulmonary congestion and edema. Hemoglobinuria was not observed in these animals, but did develop in guinea pigs exposed for an hour at 65 ppm.

"Haring and Compton reported that mice succumbed after seven and one-half hours in a concentration of 30 ppm stibine. Studies in a battery room showed the presence of stibine during overcharging but generally in concentrations below 1 ppm . . . The TLV of 0.1 ppm is based on analogy with arsine, which is reportedly somewhat more toxic than stibine."

LFL: Data not available

VAPOR PRESSURE AT 20 C: Stibine is a gas at room temperature.

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and Supporting Documentation for STIBINE

USE/EXPOSURE AND CONTROL DOCUMENT
STIBINE

	Use/Exposure	Principal Route of Entry	Currently Used Control Methods
1.	Inhalation of gas during the treatment of certain drosses (scum formed on the surface of molten metals) treated with acid. Stibine is liberated as an undesirable by-product in those cases where antimony may be present.	A	Local exhaust ventilation; general dilution ventilation; process enclosure
2.	Inhalation of gas during the charging of storage batteries. When storage batteries are overcharged, stibine gas is liberated due to the action of nascent hydrogen on the antimony in the plates.	A	Local exhaust ventilation; general dilution ventilation
3.	Inhalation of gas when alloys containing antimony or solutions containing antimony compounds come in contact with a reducing acid, nascent hydrogen or steam. Stibine is an undesirable by-product.	A	Local exhaust ventilation; general dilution ventilation; process enclosure
4.	Inhalation of gas during the purification of antimony by electrolysis - using an antimony salt in acid solutions as an electrolyte. Stibine is an undesirable by-product.	A	Local exhaust ventilation; general dilution ventilation; process enclosure
5.	Inhalation of gas during the cleaning of storage tanks. Stibine may be evolved during the cleaning of storage tanks, depending upon the composition of the tank, the cleaning method and the original contents of the tank.	A	Local exhaust ventilation; general dilution ventilation; personal protective equipment (respiratory protective devices)

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6. Inhalation of gas during
use as a chemical inter-
mediate. Stibine has
had very limited usage
in chemical synthesis.

A

Local exhaust ventilation;
general dilution ventila-
tion; process enclosure

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

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

1,019 CARDS READ

0 SYSOUT PRINT RECORDS

0 SYSOUT PUNCH RECORDS

0.00 MINUTES EXECUTION TIME

