

Occupational Health Guideline for Acetylene Tetrabromide

INTRODUCTION

This guideline is intended as a source of information for employees, employers, physicians, industrial hygienists, and other occupational health professionals who may have a need for such information. It does not attempt to present all data; rather, it presents pertinent information and data in summary form.

SUBSTANCE IDENTIFICATION

- Formula: $\text{CHBr}_2\text{CHBr}_2$
- Synonyms: Tetrabromoethane; symmetrical tetrabromoethane 1,1,2,2-tetrabromoethane
- Appearance and odor: Pale yellow liquid with a pungent odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for acetylene tetrabromide is 1 part of acetylene tetrabromide per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 14 milligrams of acetylene tetrabromide per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- Routes of exposure
Acetylene tetrabromide can affect the body if it is inhaled or if it comes in contact with the eyes or skin. It can also affect the body if it is swallowed.
- Effects of overexposure
 1. *Short-term Exposure:* Acetylene tetrabromide may cause eye and nose irritation, headache, loss of appetite, nausea, 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:* A physician should be contacted if anyone develops any signs or symptoms and suspects that they are caused by exposure to acetylene tetrabromide.

- Recommended medical surveillance

The following medical procedures should be made available to each employee who is exposed to acetylene tetrabromide at potentially hazardous levels:

1. *Initial Medical Examination:*

—A complete history and physical examination: The purpose is to detect pre-existing conditions that might place the exposed employee at increased risk, and to establish a baseline for future health monitoring. Examination of the liver should be stressed.

—Liver function tests: Acetylene tetrabromide may cause liver damage. A profile of liver function should be obtained by utilizing a medically acceptable array of biochemical tests.

2. *Periodic Medical Examination:* The aforementioned medical examinations should be repeated on an annual basis.

- Summary of 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 7-½ 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 was 1 to 2 ppm, although he had a single 10-minute period exposure to approximately 16 ppm. He

These recommendations reflect good industrial hygiene and medical surveillance practices and their implementation will assist in achieving an effective occupational health program. However, they may not be sufficient to achieve compliance with all requirements of OSHA regulations.

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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.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data

1. Molecular weight: 345.7
2. Boiling point (760 mm Hg): 239 C (462 F)
3. Specific gravity (water = 1): 2.97
4. Vapor density (air = 1 at boiling point of acetylene tetrabromide): 11.9
5. Melting point: -1 C (30 F)
6. Vapor pressure at 20 C (68 F): Less than 0.1 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): 0.065
8. Evaporation rate (butyl acetate = 1): Data not available

• 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 vapors (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 some forms of plastics, rubber, and coatings.

• Flammability

1. Not combustible

• 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 should be treated as a material with poor warning properties.

MONITORING AND MEASUREMENT PROCEDURES

• General

Measurements to determine employee exposure are best taken so that the average eight-hour exposure is based on a single eight-hour sample or on two four-hour samples. Several short-time interval samples (up to 30 minutes) may also be used to determine the average exposure level. Air samples should be taken in the

employee's breathing zone (air that would most nearly represent that inhaled by the employee).

• Method

Sampling and analyses may be performed by collection of vapors using a silica gel adsorption tube with subsequent desorption with tetrahydrofuran and gas chromatographic analysis. Also, detector tubes certified by NIOSH under 42 CFR Part 84 or other direct-reading devices calibrated to measure acetylene tetrabromide may be used. An analytical method for acetylene tetrabromide is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 2, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00260-6).

RESPIRATORS

• Good industrial hygiene practices recommend that engineering controls be used to reduce environmental concentrations to the permissible exposure level. However, there are some exceptions where respirators may be used to control exposure. Respirators may be used when engineering and work practice controls are not technically feasible, when such controls are in the process of being installed, or when they fail and need to be supplemented. Respirators may also be used for operations which require entry into tanks or closed vessels, and in emergency situations. If the use of respirators is necessary, the only respirators permitted are those that have been approved by the Mine Safety and Health Administration (formerly Mining Enforcement and Safety Administration) or by the National Institute for Occupational Safety and Health.

• In addition to respirator selection, a complete respiratory protection program should be instituted which includes regular training, maintenance, inspection, cleaning, and evaluation.

PERSONAL PROTECTIVE EQUIPMENT

• Employees should be provided with and required to 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.

• Non-impervious clothing which becomes contaminated with liquid acetylene tetrabromide should be removed promptly and not reworn until the acetylene tetrabromide is removed from the clothing.

• Clothing wet with acetylene tetrabromide should be placed in closed containers for storage until it can be discarded or until provision is made 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 person performing the operation should be informed of acetylene tetrabromide's hazardous properties.

- Employees should be provided with and required to use splash-proof safety goggles where liquid acetylene tetrabromide may contact the eyes.

SANITATION

- Skin that becomes contaminated with acetylene tetrabromide should be promptly washed or showered with soap or mild detergent and water to remove any acetylene tetrabromide.

COMMON OPERATIONS AND CONTROLS

The following list includes some common operations in which exposure to acetylene tetrabromide may occur and control methods which may be effective in each case:

Operation	Controls
Use as a catalyst or catalytic initiator in synthetic fibers; as polymer additive in flame-proof, flame-retardant polystyrenes, polyurethanes, and polyolefins	Process enclosure; local exhaust ventilation; general dilution ventilation
Use as a flotation agent in processing and separation of mineral oils	Local exhaust ventilation; general dilution ventilation; personal protective equipment
Use as mercury substitute in manufacture of gauges and balancing equipment; use as refractive index liquid in microscopy	Local exhaust ventilation; general dilution ventilation; personal protective equipment

EMERGENCY FIRST AID PROCEDURES

In the event of an emergency, institute first aid procedures and send for first aid or medical assistance.

• Eye Exposure

If acetylene tetrabromide gets into the eyes, wash 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.

• Skin Exposure

If acetylene tetrabromide gets on the skin, promptly flush the contaminated skin with water. If acetylene tetrabromide soaks through the clothing, remove the clothing promptly and wash the skin using soap or mild detergent and water. If irritation persists after washing, get medical attention.

• Breathing

If a 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 as soon as possible.

• Swallowing

When acetylene tetrabromide has been swallowed, get medical attention immediately. If medical attention is not immediately available, get the afflicted person to vomit by having him touch the back of his throat with his finger or by giving him syrup of ipecac as directed on the package. This non-prescription drug is available at most drug stores and drug counters and should be kept with emergency medical supplies in the workplace. Do not make an unconscious person vomit.

• Rescue

Move the 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. Understand the facility's emergency rescue procedures and know the locations of rescue equipment before the need arises.

SPILL, LEAK, AND DISPOSAL PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of spills or leaks until cleanup has been completed.

- 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.

- Waste disposal method:

Acetylene tetrabromide may be disposed of by absorbing it in vermiculite, dry sand, earth or a similar material and disposing in a secured sanitary landfill.

REFERENCES

- American Conference of Governmental Industrial Hygienists: "Tetrabromoethane (Acetylene Tetrabromide)," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.
- Hollingsworth, R. L., et al.: "Toxicity of Acetylene Tetrabromide Determined on Experimental Animals," *American Industrial Hygiene Association Journal*, 24:28-35, 1963.
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- Sax, N. I.: *Dangerous Properties of Industrial Materials* (3rd ed.), Van Nostrand Reinhold, New York, 1968.

- Van Haaften, A. B.: "Acute Tetrabromoethane (Acetylene Tetrabromide) Intoxication in Man," *American Industrial Hygiene Association Journal*, 30:251-256, 1969.

RESPIRATORY PROTECTION FOR ACETYLENE TETRABROMIDE

Condition	Minimum Respiratory Protection* Required Above 1 ppm
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.

*Only NIOSH-approved or MSHA-approved equipment should be used.

