Occupational Health Guideline for Tellurium Hexafluoride

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: TeF_6
- Synonyms: None
- Appearance and odor: Colorless gas with a repulsive odor.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for tellurium hexafluoride is 0.02 part of tellurium hexafluoride per million parts of air (ppm) averaged over an eight-hour work shift. This may also be expressed as 0.2 milligram of tellurium hexafluoride per cubic meter of air (mg/m^3).

HEALTH HAZARD INFORMATION

- **Routes of exposure**

Tellurium hexafluoride can affect the body if it is inhaled.

- **Effects of overexposure**

1. Short-term Exposure: Tellurium hexafluoride may cause a garlic odor to the breath, headaches, and difficulty in breathing. Tellurium exposure experience with animals indicates that delayed severe breathing difficulties might occur.

2. Long-term Exposure: None known

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 tellurium hexafluoride.

- **Recommended medical surveillance**

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

1. Initial Medical Screening: Employees should be screened for history of certain medical conditions (listed below) which might place the employee at increased risk from tellurium hexafluoride exposure.

—Chronic respiratory disease: Tellurium hexafluoride causes respiratory irritation. In persons with impaired pulmonary function, especially those with obstructive airway diseases, the breathing of tellurium hexafluoride might cause exacerbation of symptoms due to its irritant properties.

2. Periodic Medical Examination: Any employee developing the above-listed conditions should be referred for further medical examination.

- **Summary of toxicology**

Tellurium hexafluoride gas is a severe respiratory irritant. Animals exposed to 1 ppm for 4 hours developed pulmonary edema; 5 ppm for 4 hours was fatal. Human experience has indicated that exposure to tellurium hexafluoride causes headache and dyspnea. No systemic effects have been reported from industrial exposure, but relatively few studies are available.

CHEMICAL AND PHYSICAL PROPERTIES

- **Physical data**

1. Molecular weight: 241.6
2. Boiling point (760 mm Hg): −38.4 C (−38 F) (sublimes)
3. Specific gravity (water = 1): Not applicable
4. Vapor density (air = 1 at boiling point of tellurium hexafluoride): 8.3
5. Melting point: −37.8 C (−36 F) (triple-point)
6. Vapor pressure at 20 C (68 F): Greater than 1 atmosphere
7. Solubility in water, g/100 g water at 20 C (68 F): Reacts slowly
8. Evaporation rate (butyl acetate = 1): Not perti-

U.S. DEPARTMENT OF HEALTH AND HUMAN SERVICES
Public Health Service Centers for Disease Control
National Institute for Occupational Safety and Health

U.S. DEPARTMENT OF LABOR
Occupational Safety and Health Administration

nent

- **Reactivity**

1. Conditions contributing to instability: None
2. Incompatibilities: None
3. Hazardous decomposition products: Toxic gases and vapors (such as hydrogen fluoride) may be released when tellurium hexafluoride decomposes.
4. Special precautions: See 29 CFR 1910.101 for specific regulations on storage of compressed gas cylinders.

- **Flammability**

1. Not combustible

- **Warning properties**

1. Odor Threshold: No quantitative information is available concerning the odor threshold of tellurium hexafluoride. The *Documentation of TLV's*, however, notes that this gas has an unpleasant odor.
2. Eye Irritation Level: Tellurium hexafluoride is not known to be an eye irritant.
3. Evaluation of Warning Properties: Since no quantitative information is available relating its warning properties to air concentrations, this compound is 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 tellurium hexafluoride using an adsorption tube, followed by desorption with sodium hydroxide and atomic absorption spectrophotometric analysis. An analytical method for tellurium hexafluoride is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 3, 1977, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00261-4).

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.

COMMON OPERATIONS AND CONTROLS

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

Operation	Controls
Use in scientific studies on physical and chemical properties such as magnetic spin, force constants spectra, electron diffraction, crystal structure, and corrosive action	Process enclosure; local exhaust ventilation; general dilution ventilation

EMERGENCY FIRST AID PROCEDURES

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

- **Breathing**

If a person breathes in large amounts of tellurium hexafluoride, 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.

- **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.

LEAK PROCEDURES

- Persons not wearing protective equipment and clothing should be restricted from areas of leaks until cleanup has been completed.
- If tellurium hexafluoride is leaked, the following steps should be taken:

1. Ventilate area of leak to disperse gas.
2. Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped inplace, remove the leaking cylinder to a safe place in the open air, and repair the leak or allow the cylinder to empty.

REFERENCES

• American Conference of Governmental Industrial Hygienists: "Tellurium Hexafluoride," *Documentation of the Threshold Limit Values for Substances in Workroom Air* (3rd ed., 2nd printing), Cincinnati, 1974.

• American Industrial Hygiene Association: "Tellurium," *Hygienic Guide Series*, Detroit, Michigan, 1964.

• Cerwenka, E. A., Jr., and Cooper, W. C.: "Toxicology of Selenium and Tellurium and Their Compounds," *Archives of Environmental Health*, 3:189-200, 1961.

• Cooper, W. C.: *Tellurium*, Van Nostrand Reinhold, New York, 1971.

RESPIRATORY PROTECTION FOR TELLURIUM HEXAFLUORIDE

Condition	Minimum Respiratory Protection* Required Above 0.02 ppm
Gas Concentration	
0.2 ppm or less	Any supplied-air respirator. Any self-contained breathing apparatus.
1 ppm or less	Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
Greater than 1 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 tellurium hexafluoride. Any escape self-contained breathing apparatus.

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