

Occupational Health Guideline for Tantalum Metal and Oxide Dusts

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

Metallic tantalum

- Formula: Ta
- Synonyms: None
- Appearance and odor: Gray-black, odorless solid.

Tantalum pentoxide

- Formula: Ta₂O₅
- Synonyms: None
- Appearance: Colorless solid.

PERMISSIBLE EXPOSURE LIMIT (PEL)

The current OSHA standard for tantalum is 5 milligrams of tantalum per cubic meter of air (mg/m³) averaged over an eight-hour work shift.

HEALTH HAZARD INFORMATION

• Routes of exposure

Tantalum can affect the body if it is inhaled.

• 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 tantalum.

• Recommended medical surveillance

Routine medical examinations should be provided to each employee who is exposed to tantalum at potentially hazardous levels.

• Summary of toxicology

Tantalum dust has a low order of toxicity but has produced transient inflammatory lesions in the lungs of animals. Intratracheal administration of tantalum oxide to guinea pigs produced transient bronchitis, interstitial pneumonitis, and hyperemia. There were some slight residual sequelae in the form of focal hypertrophic emphysema and organizing pneumonitis around metallic deposits; there was slight epithelial hyperplasia in the bronchi and bronchioles.

CHEMICAL AND PHYSICAL PROPERTIES

• Physical data—Metallic tantalum

1. Molecular weight: 180.9
2. Boiling point (760 mm Hg): 5425 C (9997 F)
3. Specific gravity (water = 1): 16.6
4. Vapor density (air = 1 at boiling point of tantalum): Not applicable
5. Melting point: 2980 C (5396 F)
6. Vapor pressure at 20 C (68 F): 0 mm Hg
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

8. Evaporation rate (butyl acetate = 1): Not applicable

• Physical data—Tantalum pentoxide

1. Molecular weight: 441.89
2. Boiling point (760 mm Hg): Not applicable
3. Specific gravity (water = 1): 8.2
4. Vapor density (air = 1 at boiling point of tantalum pentoxide): Not applicable
5. Melting point: 1800 C (3272 F)
6. Vapor pressure at 20 C (68 F): Not applicable
7. Solubility in water, g/100 g water at 20 C (68 F): Insoluble

8. Evaporation rate (butyl acetate = 1): Not applicable

• Reactivity—Metallic tantalum

1. Conditions contributing to instability: Heat
2. Incompatibilities: Contact of tantalum (metallic dust) with strong oxidizers may cause fires and explo-

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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sions.

3. Hazardous decomposition products: None
 4. Special precautions: None
- **Flammability-Metallic tantalum**
 1. Flash point: Not applicable
 2. Minimum ignition temperature: 300 C (572 F) (layer); 630 C (1166 F) (cloud)
 3. Minimum explosion dust concentration: Less than 0.2 g/l
 4. Extinguishant: Dry sand, dry dolomite, and dry graphite
 - **Warning properties**

Tantalum is not known to be an eye irritant.

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**

An analytical method for tantalum is in the *NIOSH Manual of Analytical Methods*, 2nd Ed., Vol. 5, 1979, available from the Government Printing Office, Washington, D.C. 20402 (GPO No. 017-033-00349-1).

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 tantalum metal and oxide dusts may occur and control methods which may be effective in each case:

Operation

Liberation during refining ores, manufacture of tantalum compounds, metal, and alloys

Use in fabrication for manufacture of electronic equipment such as electrolytic capacitors used in solid-state circuitry for computers, instrumentation, and consumer items, and high-voltage surge arrestors

Use in fabrication of metals for manufacture of chemical and metallurgical processing equipment and heat exchanger

Use in fabrication of refractory non-ferrous alloys for nuclear and aerospace applications; use in manufacture of tantalum carbide for working machinery; use in manufacture of surgical metals, mesh, and clips; use in manufacture of special optical glass; and use in manufacture and repair of glass-lined equipment

Controls

General dilution ventilation; local exhaust ventilation

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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 metallic tantalum dust or tantalum oxide dust, 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.

SPILL AND DISPOSAL PROCEDURES— Metallic tantalum and tantalum pentoxide

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

- If potentially hazardous amounts of metallic tantalum or tantalum pentoxide are spilled or released, the following steps should be taken:

1. Remove all ignition sources in the case of a spill or release of metallic tantalum dust.
2. Ventilate area of spill or release.
3. Collect spilled material in the most convenient and safe manner for reclamation or for disposal in a secured sanitary landfill.

- Waste disposal method:

Tantalum and tantalum pentoxide may be disposed of in a secured sanitary landfill.

REFERENCES

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RESPIRATORY PROTECTION FOR TANTALUM

Condition	Minimum Respiratory Protection* Required Above 5 mg/m ³
Dust or Mist Concentration	
25 mg/m ³ or less	Any dust and mist respirator.
50 mg/m ³ or less	Any dust and mist respirator, except single-use or quarter-mask respirator.
Dust, Mist, or Fume Concentration	
50 mg/m ³ or less	Any fume respirator or high efficiency particulate respirator. Any supplied-air respirator. Any self-contained breathing apparatus.
250 mg/m ³ or less	A high efficiency particulate filter respirator with a full facepiece. Any supplied-air respirator with a full facepiece, helmet, or hood. Any self-contained breathing apparatus with a full facepiece.
5000 mg/m ³ or less	A powered air-purifying respirator with a high efficiency particulate filter. A Type C supplied-air respirator operated in pressure-demand or other positive pressure or continuous-flow mode.
10,000 mg/m ³ or less	A Type C supplied-air respirator with a full facepiece operated in pressure-demand or other positive pressure mode or with a full facepiece, helmet, or hood operated in continuous-flow mode.
Greater than 10,000 mg/m ³ 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.

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