



Standard Operating Procedure

OSMIUM TETROXIDE

Potential Hazards/Toxicity

Health Effects:

Exposure to osmium tetroxide via inhalation, skin contact, or ingestion can lead to systemic toxic effects involving liver and kidney damage. Osmium tetroxide is regarded as a substance with poor warning properties.

Acute Effects:

Eyes: Exposure to osmium tetroxide vapor can damage the cornea of the eye. Irritation is generally the initial symptom of exposure to low concentrations of osmium tetroxide vapor, and lacrimation, a gritty feeling in the eyes, the eyes can temporarily cloud, and the appearance of rings around lights may also be noted. In most cases, recovery occurs in a few days. Concentrations of vapor that do not cause immediate irritation can have an insidious cumulative effect; symptoms may not be noted until several hours after exposure. Contact of the eyes with concentrated solutions of this substance can cause severe damage and possible blindness.

Inhalation: Inhalation of osmium tetroxide vapors can cause headache, coughing, dizziness, lung damage, and difficult breathing and may be fatal.

Skin Contact: Contact of the vapor with skin can cause dermatitis, and direct contact with the solid can lead to severe irritation and burns.

Chronic Effects:

Chronic exposure to osmium tetroxide can result in accumulation of osmium compounds in the liver and kidney and damage to these organs. Osmium tetroxide has been reported to cause reproductive toxicity in animals; this substance has not been shown to be carcinogenic or to show reproductive or developmental toxicity in humans.

Personal Protective Equipment (PPE)

The University's Personal Protective Equipment Policy can be found on the EHS webpage (ehs.yale.edu)

The following minimum requirements for Personal Protective Equipment apply during all operations with osmium tetroxide, including 2-4% solutions:

Eye Protection

Chemical splash goggles must be worn whenever handling osmium tetroxide.

Hand Protection

Double exam style nitrile gloves must be worn when handling osmium tetroxide.

Skin and Body Protection

Long pants or clothing that covers the body to the ankles and closed-toe solid top shoes must be worn when these compounds. Lab coats, fully buttoned, must be worn.

Engineering Controls

Fume Hood

Osmium tetroxide must always be used inside a fume hood.

Storage/Handling

- Osmium tetroxide should be purchased as a liquid to avoid particulate exposure from the powdered form.
- Prepare the smallest amount of solution necessary for the procedure, typically 50 mL or less. Prepare the solution volumetrically rather than gravimetrically. If a balance must be used, weighing must take place in the chemical hood.
- Store pure osmium tetroxide and solutions in a secure location. Do not store on an open shelf or counter.
- Solutions of osmium tetroxide should be placed in tightly sealed containers inside secondary containment.
- Demarcate a fume hood where work will be conducted with osmium tetroxide and clearly mark the fume hood with signs when it is being used. The sign should identify the chemical hazard and include an appropriate warning; for example: DANGER! OSMIUM TETROXIDE IN USE – CAUSES EYE DAMAGE, HIGHLY TOXIC. The acutely toxic pictogram on the laboratory door sign also identifies the laboratory as a designated area.
 - All labware that has contacted osmium tetroxide must be decontaminated by rinsing or dipping it in corn oil or aqueous solutions of sodium sulfide or sodium sulfite before removing from the hood.
 - At the end of each project, thoroughly decontaminate the designated area before resuming normal laboratory work in the area.
 - Upon leaving the designated area, remove any personal protective equipment worn and wash hands with soap and water.

Waste Disposal

All osmium tetroxide solutions/stock materials must be collected as hazardous waste. Additionally, all items contaminated with it must be collected as hazardous waste as well. This includes empty reagent bottles, weigh boats, pipette tips, kimwipes, and other similar items that have come into contact with osmium tetroxide.

Emergency Procedures

Fire Extinguishers

Both ABC dry powder and carbon dioxide extinguishers are appropriate for most fires involving osmium tetroxide.

Eyewash/Safety Showers

An ANSI approved eyewash station that can provide quick drenching or flushing of the eyes must be immediately available within 10 seconds travel time for emergency use. An ANSI approved safety drench shower must also be available within 10 seconds travel time from where these compounds are used. Ensure the locations of the eyewashes and safety showers, and how to activate them, are known prior to an emergency.

First Aid Procedures

If inhaled

Remove to fresh air. Call 911 for immediate medical attention.

In case of skin contact

Go to the nearest emergency shower if contaminated. Yell for assistance and rinse for 15 minutes, removing all articles of clothing to ensure contaminate is completely removed. Call 911 for immediate medical attention.

In case of eye contact

Go to the nearest emergency eyewash. Yell for assistance and rinse for 15 minutes. Call 911 for immediate medical attention.

Spills

Small Spill (inside a fume hood)

If a small spill occurs inside a fume hood, lab personnel should be able to safely clean it up by following standard spill clean up procedures:

- Alert people in immediate area of spill
- Wear personal protective equipment, including utility grade nitrile gloves
- Cover the spill with corn oil-soaked kitty litter
- Collect residue, place in container, label container, and dispose of as hazardous waste
- Clean spill area with an aqueous solution of sodium sulfite
- Clean the spill area with soap and water

Larger Spill/Any spill outside a fume hood

- Call EHS for emergency assistance (203-785-3555)
- Evacuate the spill area
- Post someone or mark-off the hazardous area with tape and warning signs to keep other people from entering
- Stay nearby until emergency personnel arrive and provide them with information on the chemicals involved