






## LABORATORY SAFETY GUIDELINE

### Osmium Tetroxide [CAS No. 20816-12-0]

All users of Osmium Tetroxide must review this document before use. Osmium tetroxide ( $\text{OsO}_4$ ) is a highly poisonous, pale yellow solid that is volatile. It is a corrosive oxidizer that produces an acrid chlorine like odor. Osmium tetroxide is most commonly used in oxidation reactions and as a fixative for biological staining. Users should contact their EHS Laboratory Safety Advisor and department safety officer if they have questions before beginning work.

### HAZARDS

	The acute toxicity is high, and it is a severe irritant of the eyes and respiratory tract. Vapors can damage the cornea of the eye and even lead to blindness. Concentrations of vapor that do not cause immediate irritation can have a dangerous cumulative effect; symptoms may not be noted until several hours after exposure. Inhalation can cause chemical burns to the respiratory tract, headache, coughing, dizziness, lung damage, and difficult breathing, and may potentially be fatal.
	Chronic exposure can result in accumulation of osmium compounds in the liver and kidney, and damage to these organs. Exposure via inhalation, skin contact, or ingestion can lead to systemic toxic effects involving liver and kidney damage. Repeated exposure may cause sensitization by inhalation or skin contact.
	Corrosive to skin and eyes, exposure may cause blindness. Contact of the vapor with skin can cause dermatitis, and direct contact with the solid can lead to severe irritation and burns.

### PRECAUTIONS

- Osmium tetroxide is a strong oxidizer that will sublime (pass directly from solid to vapor and back to solid) readily at room temperature and significantly when refrigerated. Open all containers in the fume hood, including dry powders and concentrated solutions.
- Keep container tightly closed in a dry and well-ventilated place. If storing in accordance to recommended storage temperature: 2 - 8 °C, place osmium in a tightly closed secondary container.
- Osmium tetroxide is a strong oxidizer and can react with easily oxidized organic materials to cause fires or explosions.
- Osmium tetroxide in contact with hydrochloric acid will cause formation of poisonous chlorine gas.
- Keep osmium tetroxide away from hydrochloric acid, other acids, bases, organic materials, metals, strong reducing agents and strong oxidizing agents. Contact with combustible material could cause fire. Osmium tetroxide can penetrate plastics and therefore needs to be stored in glass in a laboratory refrigerator.
- If weighing osmium tetroxide powder and the balance cannot be located in a chemical fume hood, tare a container then add the powdered osmium tetroxide to the container in a chemical fume hood (NOT a Biological Safety Cabinet) and seal the container before returning to the balance to weigh the powder.
- Dry powders and concentrated solutions must be in sealed shatter-resistant containers, within secondary containment, during storage and transportation.

#### **Before starting work:**

- Determine if you can use a less hazardous substance in place of Osmium tetroxide;
- Review manufacturer's Safety Data Sheet and additional chemical information at [ehs.harvard.edu/safety-data-sheets-sds](https://ehs.harvard.edu/safety-data-sheets-sds);

- Ensure that a written experimental protocol including safety information is available;
- Be familiar with general University emergency procedures in the [EHS Lab Emergency Response Guide](#);
- Order the most dilute solutions available that will meet experimental needs. Order only the quantity that you need;
- Recommended to purchase the liquid form of osmium tetroxide whenever possible.
- Identify the location of the nearest eyewash and shower and verify that they are accessible;
- Locate and verify that appropriate spill cleanup materials are available, including the following:
  - Neutralizer: corn oil or sodium sulfide
  - Absorbent material: vermiculite or kitty litter
- Ensure another person who knows emergency procedures is in the area.

### **During work:**

- Do not remove osmium tetroxide from secondary container until it is fully in the fume hood.
- When osmium tetroxide is in use, warning signs must be posted on the chemical fume hood until it has been returned to storage.
- AVOID INHALATION! Perform all operations in a certified chemical fume hood or other approved ventilated enclosure. Sash lowered as much as possible. Always work at least 6 inches into the fume hood and behind the sash. Ensure fume hood baffles are not blocked and there is proper airflow;
- AVOID CONTACT! Use appropriate personal protective equipment (PPE):
  - Wear a cuffed lab coat, a garment covering to the ankles, and closed-toed shoes;
  - Chemical goggles; safety glasses DO NOT offer adequate protection from osmium tetroxide vapors.
  - When using or handling osmium tetroxide, no area of the skin or eyes should be exposed.
  - Nitrile gloves, double glove when working with pure or highly concentrated solutions
    - Always consult Safety Data Sheet to ensure proper glove selection
    - Gloves must be thoroughly inspected prior to each use. Do not use damaged gloves;
    - Change gloves whenever you suspect they have become contaminated;
    - Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact;
    - Wash hands and forearms thoroughly with soap and water each time gloves are removed;
- Use materials and containers appropriate for osmium tetroxide use and remain aware of potential incompatibilities; Handle and store osmium tetroxide in glass containers, not recommended for plastic containers.
- Keep all containers tightly closed when not in use and during transport.

### **After completing the work:**

- Osmium tetroxide vapors can penetrate plastics, therefore should be stored in sealed glass containers with unbreakable secondary containment.
- Dispose of osmium tetroxide waste following Harvard University [Hazardous Waste Procedures](#)
  - Hazardous Waste Classification: Corrosive and Toxic
  - Osmium tetroxide must be deactivated once work is done and considered hazardous waste.
  - A 2% osmium tetroxide solution will be fully deactivated by two-times the volume of corn oil (corn oil is preferred because of its high percentage of unsaturated bonds).
  - Pour the corn oil into the osmium tetroxide solution and wait for the oil to turn completely black. To test if osmium tetroxide is fully neutralized, hold a piece of filter paper soaked in corn oil over the solution. Blackening of the filter paper indicates that osmium tetroxide is still present, and more corn oil should be added. The corn oil and osmium tetroxide solution must be disposed of as chemical hazardous waste.
  - Solutions of sodium sulfide or sodium sulfite will also reduce aqueous solutions of osmium tetroxide to a less hazardous form. The used solutions must be disposed of as chemical hazardous waste.
- Return container to storage area following Harvard University [Laboratory Chemical Storage Guide](#)
  - Store in original containers or other appropriate containers;
  - Store primary container in designated and compatible secondary containers;
- Store away from incompatibles; Keep osmium tetroxide away from hydrochloric acid, other acids, bases, organic materials, metals, strong reducing agents and strong oxidizing agents.
- All lab ware that has contacted osmium tetroxide should be decontaminated by rinsing or dipping in corn oil or aqueous solutions of sodium sulfide or sulfite before removing from the hood. Corn oil is highly recommended for decontamination as it reacts with and thus quenches the reactive osmium tetroxide. Similarly, aqueous forms of sodium sulfide or sodium sulfite reduce osmium tetroxide to a less hazardous form.
- Wash hands and forearms thoroughly with soap and water before leaving the lab.

## **EMERGENCY PROCEDURES**

### **First Aid**

#### SKIN CONTACT

- Wash with plenty of tepid water for at least 15 minutes using the closest available sink, safety shower or drench hose. Remove any exposed clothing as well as any jewelry.
- Seek medical attention; call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

#### EYE CONTACT

- Using eyewash, flush eyes while holding upper and lower eyelids open for 15 minutes;
- Seek medical attention; call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

#### INHALATION

- Leave the immediately to an area with fresh air;
- Seek medical attention; call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

#### INGESTION

- Never give anything by mouth to an unconscious person;
- Seek medical attention; call 911 on a landline phone for medical assistance (or provide location if calling on a mobile phone).

### **Spill Response**

#### OUTSIDE FUME HOOD OR VENTILATED ENCLOSURE

- Alert others and evacuate to a safe distance and prevent entry.
- Contact the University Operations Center at (617) 495-5560 [HMS/HSDM (617) 432-1901]
- Remain in a safe location until EH&S or other response personnel arrive.

#### INSIDE FUME HOOD OR VENTILATED ENCLOSURE (< 500 ml)

- If trained and confident, you may assist in the clean-up effort of small amounts, wearing PPE described above and using appropriate spill supplies.
  - Cover the spill area with corn oil. Oil will turn black when it reacts with osmium tetroxide.
  - Absorb the corn oil and osmium tetroxide solution with absorbent material from spill kit.
  - Collect debris in appropriate container and move to your Satellite Accumulation Area. Label with appropriately completed hazardous waste tag and request a waste pickup.
  - Clean area with detergent solution to remove residual corn oil.
- Otherwise close the fume hood sash and await support.
- Contact the University Operations Center at (617) 495-5560 [HMS/HSDM (617) 432-1901] if you need support or technical assistance.