Laboratory Standard Operating Procedure for:

Osmium Tetroxide

Principal Investigator (PI) Approval is Required Prior to Performing this Procedure

Description

This standard operating procedure outlines the handling and use of osmium tetroxide. Review this document and supply the information required in order to make it specific to your laboratory. In accordance with this document, laboratories should use appropriate controls, personal protective equipment, and disposal techniques when handling osmium tetroxide.

Osmium tetroxide is a colorless to pale yellow solid with a strong, unpleasant odor. It is used as a catalyst in chemical reactions as well as for microscope tissue staining activities.

Potential Hazards

Consult the safety data sheet (SDS) and the Laboratory Chemical Safety Summary for Osmium Tetroxide from *Prudent Practices in the Laboratory* (The National Academies Press).

Be aware of these specific hazards:

- 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.
- It is highly toxic (LD50 oral [rat] 14 mg/kg) – ingesting very small amounts can cause death. It is also a severe eye and respiratory irritant – acute exposure can cause severe eye damage, even blindness, or chemical burns to the respiratory tract. It can also cause dermatitis or lung or kidney damage.
- The MIOSHA Permissible Exposure Limit is 0.002 mg/m^3 over 8 hours. The ACGIH Threshold Limit Value is 0.0002 ppm over 8 hours or 0.0006 ppm over 15 minutes.
- 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.

Engineering Controls

- Always work with osmium tetroxide in a chemical fume hood – never on an open benchtop.
- Use of a Biological Safety Cabinet for working with osmium tetroxide is not appropriate because it sublimes and the BSC is not designed to prevent exposure to vapors.
- An eyewash-drench hose must be available in the immediate area. A safety shower is highly recommended – please contact EHS at (313) 593-4914 for consultation if a safety shower is not currently available in your area.

Work Practice Controls

- Use a less dangerous product than osmium tetroxide if possible, or purchase in dilute solution.
- Purchase a minimal amount of osmium tetroxide to do your work.
- Purchase in liquid form if at all possible.

- Keep corn oil on hand to use for decontamination and in case of a spill – it deactivates osmium tetroxide.
- Set up a designated area for work with osmium tetroxide and suspensions thereof, and label it with the following wording: DANGER: Osmium Tetroxide in use. Oxidizing Agent, Severe Irritant, Causes Eye Damage, Toxic to Liver and Kidney, Authorized Personnel Only.
- Line work surfaces with plastic-backed absorbent pads.
- Keep containers closed as much as possible.
- 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.
- Change gloves regularly (at least every two hours) and wash hands at the time of the glove change.
- Wash hands thoroughly immediately after working with any concentration of osmium tetroxide.
- Contaminated containers and equipment may be decontaminated by dipping in corn oil before removing from the hood. The corn oil will turn black. Paper soaked with corn oil may be used to test if the osmium tetroxide is fully neutralized – if the paper blackens, osmium tetroxide is still present and more corn oil should be added.
- Contaminated work surfaces may be decontaminated with corn oil or an aqueous solution of sodium sulfite, followed by a cleaning with detergent and water.

Personal Protective Equipment

- Two pairs of standard nitrile laboratory gloves and a fully buttoned lab coat with sleeves extending to the wrists must be worn when handling osmium tetroxide. Chemical-protective sleeves or wrist guards, or extended-cuff gloves are recommended.
- Wear chemical splash goggles (safety glasses are not sufficient). If there is risk of splash, also wear a face shield.
- In cases where the arms or torso may be exposed to liquid suspensions or dry particles, wear chemical-protective sleeves or gowns.

Transportation and Storage

- Dry powders and concentrated solutions must be in sealed shatter-resistant containers, within secondary containment, during storage and transportation.
- Osmium tetroxide powder and concentrated solutions should be stored in a secure location (no unauthorized access).
- Osmium tetroxide can penetrate plastic, so it should be stored in a sealed glass container (such as a vacuum-type blood collection tube), and placed inside a secondary container.
- Osmium tetroxide should be kept in a refrigerator, and should be stored separately from hydrochloric acid as well as other acids, bases, organic materials, metals, strong reducing agents, and strong oxidizing agents.

Waste Disposal

Unwanted osmium tetroxide (solid and solutions) must be disposed of following your laboratory-specific chemical hygiene plan. Because most spent, unused and expired chemicals/materials are considered hazardous wastes, they must be properly disposed of. ***Do not dispose of chemical wastes by dumping them down a sink, flushing in a toilet or discarding in regular trash containers.*** Contact EHS at (313) 593-0921 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to EHS's Hazardous Waste Webpage for more information.

Exposures/Unintended Contact

 ***If the employee is in need of emergency medical attention, call 911 immediately.*** 

In general, flush affected eyes or skin with water for at least 15 minutes, then seek medical attention (see below).

- **Eyes:** In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. *Remove contact lenses if present and easy to do*. Continue rinsing. Get medical aid (see below).
- **Skin:** In case of contact, flush skin with plenty of water. Remove contaminated clothing and shoes. Get medical aid if irritation develops and persists. Wash clothing before reuse.
- **Ingestion:** If swallowed, **do not induce vomiting unless directed to do so by medical personnel**. Never give anything by mouth to an unconscious person. Get medical aid (see below).
- **Inhalation:** If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical aid (see below). Seek medical attention.

Report all work related accidents, injuries, illnesses or exposures to WorkConnections within 24 hours by completing and submitting the Illness and Injury Report Form. Follow the directions on the WorkConnections website Forms Instructions to obtain proper medical treatment and follow-up.

Complete the EHS Laboratory Incident and Near-Miss Report form.

TREATMENT FACILITIES:

Midwest Medical Center -- *Campus Employees (including student employees)*
Mon-Fri 7:30 am - 4:30 pm
9301 Middlebelt Road
Romulus, MI 48174
Phone: 734-941-1000

After hours - go to:

Midwest Medical Center
Open 24/7
4700 Schaefer
Dearborn, MI 48126
Phone: 313-581-2600

Henry Ford Medical Center-Fairlane -- *University students (non-life threatening conditions)*
19401 Hubbard Drive
Dearborn, MI 48126
Phone: 313-928-8278

Click here for more information.

Spill Procedure

For cleaning up a small spill (<2 ml) of osmium tetroxide solution (or powder if confined to a chemical fume hood), cover the spill with corn oil-soaked kitty litter, then scoop up the material and place it in a plastic bag. After spill has been

absorbed, wipe down area again with corn-oil, then soap and water solution to decontaminate. Contact EHS at (734) (313) 593-0921 for pick-up.

Spills of osmium tetroxide powder or spills of solution > 2 ml outside of a chemical fume hood or other enclosure should be referred to the EHS by calling (313) 593-5333.

- When a spill occurs, ***personal safety should always come first***.
- Alert and clear everyone in the immediate area where the spill occurred.

A **minor (small) chemical spill** is one that the laboratory staff is capable of handling safely without the assistance of safety and emergency personnel, i.e., less than 2 ml. A **major/large chemical spill** requires active assistance from emergency personnel.

Spill Response Steps:

MINOR CHEMICAL SPILL

- Alert people in immediate area of spill.
- Open outside windows, if possible.
- Wear personal protective equipment as indicated above.
- Avoid breathing vapors from spill.
- Confine spill to as small an area as possible.
- **Do not wash spill down the drain**.
- Use appropriate spill kits/sorbents to absorb spill. Collect contaminated materials and residues and place in container. For powdered chemicals sweep carefully to avoid generation of dust or, if appropriate, use moist sorbent pads or wet the powder with a suitable solvent and then wipe with a dry cloth. Contact EHS at (313) 593-0921 for proper disposal.
- Clean spill area with water.

MAJOR CHEMICAL SPILL

- Attend to injured or contaminated persons and remove them from exposure.
- Alert people in the laboratory to evacuate.
- **Call Public Safety at (313) 593-5333 or 911 from a campus phone immediately for assistance.**
- Close doors to affected area.
- Post warnings to keep people from entering the area.
- Have person available that has knowledge of incident and laboratory to assist emergency personnel.

Additional Spill Links:

- Chemical Spill Control Information

Report all emergencies, suspicious activity, injuries, spills, and fires to Public Safety by calling at (313) 593-5333 or 911 from a campus phone. Register with the University of Michigan-Dearborn Emergency Alert System.

Training of personnel

All personnel are required to complete the ***Comprehensive Laboratory Safety*** session (**BLS009** *or equivalent*) via MyLINC. Furthermore, all personnel shall read and fully adhere to this SOP when handling osmium tetroxide.

Certification

I have read and understand the above SOP. I agree to contact my Supervisor or Lab manager if I plan to modify this procedure.

Name	Signature	UM ID #	Date

Principal Investigator _____ **Revision Date** _____