STANDARD OPERATING PROCEDURE
OSMIUM TETROXIDE

Date: _____ Principal Investigator: _____
Room and Building: _____Phone: _____

#1 Hazardous Chemical
OSMIUM TETROXIDE

#2 Description
Synonyms: osmic acid, perosmic acid, osmium (VIII) oxide, OsO_4 CAS: 20816-12-0

Osmium tetroxide is a highly volatile, highly toxic chemical that is used in electron microscopy staining and as a biological fixative.

Permissible exposure limits: MIOSHA TWA=0.002 mg/m^3; MIOSHA STEL = 0.006mg/m^3

#3 Potential Hazards
Osmium tetroxide is a strong oxidizer that will sublime readily at room temperature. Contact with combustible materials may cause fire. Reaction with hydrochloric acid will produce chlorine gas.

Osmium tetroxide is acutely toxic, and is a severe irritant to the eyes and respiratory tract. Osmium tetroxide vapor can cause staining to the cornea at low levels of exposure. Initial symptoms of eye exposure can include lacrimation and grittiness in the eye, and may also include the appearance of rings and/or cloudiness of the vision. Cumulative exposure can result in delayed onset of symptoms several hours after exposure.

Inhalation of osmium tetroxide vapors can cause coughing, difficulty breathing and may be fatal.

Skin contact can cause dermatitis, severe irritation or chemical burns.

Chronic exposure to osmium tetroxide can result in accumulation of osmium compounds in the liver and kidney. It has been reported as a reproductive toxin in animals.

Small, chronic exposures to osmium tetroxide via inhalation, skin contact or eye contact can lead to systemic health effects over time.

#4 Personal Protective Equipment
The following is the minimum personal protective equipment when working with osmium tetroxide:
1. Chemical goggles. Safety glasses DO NOT offer adequate protection from osmium tetroxide vapors.

2. Nitrile gloves - doubled when working with pure or highly concentrated solutions. DO NOT use latex gloves with any concentration of this compound. Wash hands after removing gloves. Change gloves often and when punctured or torn.
3. Laboratory coat. If the lab coat becomes contaminated with OsO_4, remove, place in fume hood and decontaminate spill area with corn oil. Double-bag laboratory coat and send to MSU EHS for disposal.
4. Close-toe shoes, long pants.

#5 Engineering Controls

Osmium tetroxide must be handled in a certified fume hood - never on an open bench.
Biosafety hoods do not offer adequate protection.
Keep hood clear of flammable/combustible materials and keep baffles clear of debris. Ensure fume hood is in working order before beginning work. Keep sash as low as possible without impeding work processes.

#6 Special Handling and storage procedures

Do not remove osmium tetroxide from secondary container until it is fully in the fume hood.
Osmium tetroxide vapors can penetrate plastics; therefore osmium tetroxide should be stored in sealed glass containers with unbreakable secondary containment. Refrigeration of the product can reduce sublimation; however this product should not be stored with other chemicals inside a refrigerator. A small refrigerator dedicated to osmium tetroxide storage can be used.
Store OsO_4 powder and solutions in a secure location, preferably in a locked refrigerator (see above)
Keep away from hydrochloric acid, other acids, bases, organic materials, metals, strong reducing agents and strong oxidizing agents.
Ensure safety shower and emergency eyewash are available and in working order.

#7 Spill and Accident Procedures

Small spills inside fume hood (<2ml):
1. Ensure appropriate PPE is worn (see #4 above)
2. Cover the spill with corn oil. Oil will turn black when it reacts with the OsO_4
3. Absorb the corn oil/OsO_4 solution with absorbent from spill kit.
4. Scoop up and place in doubled plastic bag. Attach appropriate waste tag and submit waste request online.
5. Clean area with detergent solution to remove residual corn oil.

Larger spills (>2ml) and spills outside of the fume hood:
1. Alert other personnel in the immediate area
2. Evacuate area, closing all doors to the laboratory
3. Telephone MSU EHS at 355-0153 for assistance, or 355-2222 after hours
4. Telephone 911 if an injury or fire has occurred as a result of the spill
5. Keep others from entering area until MSU EHS confirms area is safe for occupancy

Chemical exposure:
1. If vapor has been inhaled, move victim to fresh air immediately
2. If osmium tetroxide has been splashed on skin or in eyes, begin rinsing affected area with copious amounts of water
3. Telephone 911 immediately and request medical assistance
4. Give MSDS to emergency personnel

#8 Decontamination Procedures

Osmium tetroxide powder and solutions should be combined with corn oil before disposing via MSU EHS. Ensure compound is neutralized by placing a piece of filter paper soaked in corn oil above the solution. If the filter paper turns black, the solution has not been effectively neutralized - more corn oil should be added to the solution.

Osmium tetroxide solutions that cannot be placed in corn oil must be sent for waste disposal via EHS in a glass container with a shatterproof secondary container in place.

Debris contaminated with OsO_4 (gloves, paper, tips, etc.) must be neutralized with corn oil before sending for disposal. Place debris in double-lined cardboard box after neutralization with corn oil.

#9 Waste Disposal Procedures

All osmium tetroxide liquid and solid waste must be disposed of via MSU EHS, regardless of concentration of the solution.

Do not dispose of osmium tetroxide in sink or trash can.

Double bag contaminated debris. Keep osmium tetroxide waste in the fume hood until waste pickup.

Empty containers of osmium tetroxide should be disposed of as hazardous waste.

#10 MSDS

Osmium Tetroxide MSDS can be found here:
http://www.orcbs.msu.edu/msds/080904_LLQ_031_OSMIUMTETR.PDF

Keep printed copy in laboratory in case of emergency

#11 Administrative Controls

1. All users must be current on MSU EHS online training modules for chemical safety and hazardous waste

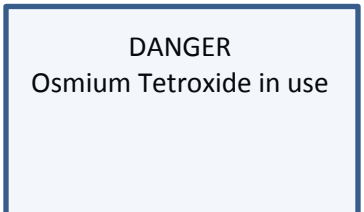
2. Ensure all users (and persons in immediate working area) have read, reviewed and signed this SOP before beginning work

3. Do not allow undergraduate students to work with osmium tetroxide in any form

4. Do not work alone when using or manipulating pure osmium tetroxide or osmium tetroxide solutions

5. Place a copy of the osmium tetroxide MSDS in close proximity to the work area in case of emergency

6. Post warning signs on areas where osmium tetroxide is used and/or stored:



Highly toxic
Severe irritant
Causes eye damage

#12 Protocol

Describe process or procedures in detail here