



Duke OESO Guidelines for Safe Use of Osmium Tetroxide (OsO₄)



Lab-specific Safety Information on page 2 **MUST BE APPROVED** in advance by OESO and the PI.

Hazards	Potential Hazards	<ul style="list-style-type: none"> • Solid is fatal if inhaled (category 1) or if swallowed or in contact with skin (category 2). • 2% and 4% solutions are fatal if inhaled (category 1), category 3 oral and category 4 dermal. Solutions are also respiratory sensitizers (category 1), serious eye damage (category 1) and skin irritation (category 2). High risk. • Causes severe skin burns and eye damage; lachrymator. Has an unpleasant chlorine-like odor and also has poor warning properties (odor detectable only above exposure limit). • May cause allergy or asthma symptoms or breathing difficulties if inhaled. • Symptoms may be delayed. • Exposure limit (OSHA): 0.002mg/m³ (0.0002 ppm) – 8 hr TWA; Short term (NIOSH, ACGIH):0.0006 ppm. Chronic exposure causes damage to the liver and kidney. • Sublimes readily at room temp and significantly when refrigerated. • Consult the Safety Data Sheet (SDS) and the Laboratory Chemical Safety Summary.
	Selection & Purchase	<ul style="list-style-type: none"> • Use a less dangerous product if possible. • Purchase in solution or in pre-weighed ampule. • Purchase corn oil for decontamination and spill clean-up.
Hazard Controls	Storage & Transportation	<ul style="list-style-type: none"> • Solid and solutions: store and transport in sealed, glass (OsO₄ penetrates plastic), shatter-resistant containers within secondary containment. Use Teflon tape to reseal any solutions. • Store in a dry and well-ventilated place; keep storage area secure. • Container must be kept away from strong reducing agents, organic materials, powdered metals, and hydrochloric acid.
	Engineering Controls	<ul style="list-style-type: none"> • Eyewash (preferably with drench hose) is required. • A safety shower is highly recommended. <div style="display: flex; align-items: center; justify-content: center;"> <ul style="list-style-type: none"> • All work must be done in a chemical fume hood. NO BSCs! • Open only inside hood. </div>
	Work Practice Controls	<ul style="list-style-type: none"> • Designate a specific area for osmium tetroxide use and label it. • Keep containers closed and tightly sealed as much as possible. • If possible, purchase as solution OR make the entire ampule into a solution and then aliquot the solution for use. • If weighing is necessary, place balance in hood OR use Tare Method → → → • Decontaminate containers, equipment, & surfaces with corn oil. If OsO₄ is still present, the oil will turn black. Use this as an indicator to ensure decon is complete. <div style="border: 1px solid black; padding: 5px; margin-top: 10px; display: inline-block;"> <p style="text-align: center; color: red; margin: 0;">Osmium Tetroxide Work Area Danger! Toxic! Corrosive!</p> </div> <div style="border: 1px solid green; padding: 5px; margin-top: 10px; display: inline-block;"> <ul style="list-style-type: none"> • Tare (pre-weigh) empty glass container with lid. • Go to hood, add solid, close lid. • Go to balance to weigh. • Return to hood. </div>
	Personal Protective Equipment	<p>Minimum PPE:</p> <ul style="list-style-type: none"> • Safety goggles and face shield (8" length min.) • If using the solid, use 2 pairs nitrile gloves (inspect for defects before use) • If using solutions, 1 pair of nitrile gloves will be sufficient. <ul style="list-style-type: none"> • <i>Avoid glove contact & change gloves at least every 30 minutes.</i> • Fully buttoned lab coat with sleeves extending to the wrists. <p>Risk of splash (or for spill clean-up):</p> <ul style="list-style-type: none"> • Chemical-resistant sleeves and apron over lab coat <div style="text-align: right; margin-top: 10px;"> </div> <p style="color: red; margin-top: 10px;"><i>Check the manufacturer's glove guide for glove effectiveness if using a solvent other than water.</i></p>

Other	Medical Emergencies	<ul style="list-style-type: none"> • See Emergency Response webpage or flip chart and/or lab specific chemical hygiene plan • Exposed persons: seek immediate medical attention at the nearest Emergency Room.
	Spills	<ul style="list-style-type: none"> • Spill >1 g or outside hood: Call 911 from a campus phone or 919-684-2444 from any phone. • Spills < 1 g in hood: Cover spill with corn oil-soaked inert absorbent. Scoop, double bag & seal. • AFTER the spill is absorbed, wipe area with corn oil, then soap and water.
	Waste	OsO4 is P-listed waste . Accumulate separately. Submit empty containers (including syringes) as waste if OsO4 was the only active ingredient in the container. NO DRAIN DISPOSAL . See lab-specific chemical hygiene plan and Lab Chemical Waste Management Practice for more information.
	Training	Sign lab-specific Chemical Hygiene Plan to indicate review.
	Questions	Contact OESO Lab Safety at 919-684-8822 or labsafety@dm.duke.edu .



Lab-Specific Safety Information for Osmium Tetroxide



Supplements the Guidelines for Safe Use of Osmium Tetroxide
Must be approved by OESO and PI below.

Lab Info	PI Name	Mark Walters	PI Approval (signature): Date: 2/22/2021	
	Location	Fitzpatrick CIEMAS Room 1562 (Sample Prep Lab)		
	OESO approval	Courtney Stanion	Signature: Date: 4/6/2021	
Lab-Specific Hazard Controls	Purchase Details	Maximum container size	10 ml of 4% solution	
		Maximum concentration	Received as 4% solution	
		Container type	Vacuum sealed vials within secondary containment	
		Specific product info.	Electron Microscopy Sciences, 19190	
	Storage	Specific location	1% solution: Refrigerator in Fitzpatrick CIEMAS Room 1562 (Sample Prep Lab) 4% solution: Refrigerator in locked chase (microCT lab).	
	Use Information	Designated work area (specific room(s) and area(s))	Fitzpatrick CIEMAS Room 1562 (Sample Prep Lab)	Label work area!
		Type of container to use	Glass container with screw top, further sealed with parafilm.	NO PLASTIC!
		Maximum quantity	10 ml of 4% solution, or 40 ml of 1% solution	
		Location of supplies for decontamination (or spill clean-up)	Corn Oil: Beside hood in 1562 Sample Prep lab Inert Absorbent: Beside hood in 1562 sample prep lab	
	Waste Information	Details about waste - location, type of container	Unwanted osmium tetroxide solutions and contaminated items must be disposed of following the SMIF chemical waste disposal plan, Duke University's Chemical Waste Policy and the Laboratory Chemical Waste Management Practices. These policies cover container management and procedures and timelines for chemical waste pickup. Empty containers are submitted as waste	Accumulate Separately! No plastic!
Details of Process	<ul style="list-style-type: none"> When needed by SMIF users, SMIF staff further dilutes the osmium tetroxide to a 1% solution in a single 40 mL glass bottle. This bottle is stored in a refrigerator in the Sample Prep Lab (in a box for secondary containment) and used as needed until it runs out. SMIF users are only allowed to use the 1% solution out of the 40 mL bottles. Use only in the designated chemical hood that is labeled with the following: DANGER: Osmium Tetroxide in use			