

Standard Operating Procedure
for work with

Chemical name/class: <u>Sulfuric Acid</u>	CAS #: <u>7664-93-9</u>
PI: <u>Mark Walters</u>	Date: <u>March 1, 2021</u>
Building: <u>Fitzpatrick CIEMAS</u>	Room #: <u>Cleanroom and Sample Prep</u>
Designated Work: <u>Chemical processing with Acids and Bases</u>	

1. **Circumstances of Use:**

Sulfuric Acid typically used in SMIF for wet chemical etching or cleaning. Many photoresist developers are base solutions.

2. **Potential Hazards:**

Consult the Safety Data Sheet (SDS) for the particular acid you are using

Be aware of these specific hazards:

- Sulfuric Acid can react explosively with organics. Never mix acids with solvents or with Acetic Acid.
- Sulfuric acid reacts with metals to produce hydrogen gas, which is flammable and explosive. Keep away from metals and metal surfaces.
- Sulfuric Acid is corrosive and cause severe skin burns and serious eye damage. They can also burn mucosal membranes, and the respiratory tract.
- Sulfuric Acid is considered particularly hazardous because it is a possible carcinogen.

3. **Engineering Controls:**

- Always work sulfuric in a designated acid fume hood in the Clean Room or Sample Preparation Lab.
- An eyewash and safety shower are available in the immediate area.

4. **Work Practice Controls:**

- Use only in a designated acid chemical hood.
- Keep containers closed as much as possible. Only open a container when it is inside a designated acid chemical hood and you are wearing the proper PPE (section 5).
- When diluting, add acid to water slowly, in small amounts. (Never add water to acid!)
- Contaminated items are to be disposed of properly as hazardous waste, following SMIF's hazardous waste policy (see section 7).

5. **Personal protective equipment (PPE):**

- Wear chemical gloves
 - Always first check chemical gloves for holes or damage
 - If damaged, dispose of the gloves and get a new pair
 - Never purposefully touch a chemical even while wearing the chemical gloves. If a glove does come in contact with a chemical
 - Remove the exposed glove and dispose of it.
 - Get a new pair of gloves
 - Wear gloves to open chemical cabinets.
 - Wash and remove gloves before touching anything else (door knobs, notebooks, phone, microscopes, etc.)
- Wear chemical splash goggles (safety glasses are not sufficient).
- Wear a face shield.
- Wear a chemical-protective gown with sleeves.

6. **Transportation and Storage:**

- Sulfuric acid must be in sealed shatter-resistant container and stored in an exhausted chemical cabinet designated for acids.
- Wear the designated PPE (section 5) when transporting an acid bottle or container to a chemical hood.

7. **Waste Disposal:**

Liquid Waste

Pour all sulfuric acid waste into the acid hood sink drain for proper disposal. These drains lead into a house acid waste neutralization system.

- Press the **Drain** button to open the drain
 - The drain will not open if chemicals are above 50°C
 - The drain has a water dilution in it to reduce the chemical waste concentration
- Rinse the sink with water from the gooseneck or water sprayer after draining chemicals to wash out any residues
- Press the **Drain** button to close the drain. ***Do not leave the drain open if it is not needed.***

Solid Waste

Solid materials that are contaminated with chemical acid waste (such as wipes, dispensers, etc.) should be packed into a zip lock bag and properly labeled with the type of waste, your name, and date. The waste bag should be completely sealed.

- Bagged and labeled solid acid waste can be left in the back of the hood for pickup by SMIF staff
- Empty acid bottles should be rinsed in the sink and left in the hood for pickup by SMIF staff

8. **Exposures/Unintended contact:**

Contact Employee Occupational Health and Wellness (EOHW) at 919-684-3136 for medical advice on occupational chemical exposures. For an actual chemical exposure

- Flush exposed eyes or skin with water for at least 15 minutes.
- If there is respiratory irritation associated with exposure, remove all persons from the contaminated area and contact the OESO spill team.
- Exposed persons should seek immediate medical attention at the nearest emergency department/
- Call 911 from a campus phone or 919-684-2444 from any phone to request assistance if needed. Contact Employee Occupational Health and Wellness at 919-684-8115 for exposure-related advice.

The work-related injury or illness report found at: <http://www.hr.duke.edu/benefits/medical/workcomp/report.php> should be completed within 24 hours. Follow-up medical attention should be sought through Duke Employee Occupational Health and Wellness (919-684-3136).

9. **Spill Procedure:**

In the event of a spill, follow SMIF spill procedures and immediately contact SMIF staff. Only SMIF staff and/or appropriate OESO personnel should clean up spills

Spills Contained Inside a Chemical Hood

- Avoid breathing vapors from the spill and leave the immediate area of the chemical hood
- Alert people in the immediate area of the spill
- Notify SMIF immediately by calling emergency numbers posted near the phone
- Wait for instructions from SMIF or for SMIF personnel to arrive to complete the clean-up of the affected area.

Spills Outside of a Chemical Hood

- Attend to injured or contaminated persons and remove them from exposure
- Press the closest manual alarm button (blue box) and evacuate the lab
- Make yourself available to the SMIF staff and/or emergency responders and be prepared to tell the following: What chemical(s) are involved, how much was spilled, where the spill is located, nature of any injuries

10. **Training of personnel:**

- All personnel are required to complete the SMIF General Lab Safety session and the SMIF Chemical Safety and Wet Hood training session.
- All personnel shall read and fully adhere to the ***Wet Hood Operating Procedure*** and the ***SMIF Lab Safety and Procedures Manual***

Duke OESO Guidelines for Safe Use of SULFURIC ACID

Complete *Lab-Specific Safety Information* on page 2



Hazards	Potential Hazards	<ul style="list-style-type: none"> • Corrosive - causes severe skin burns and serious eye damage. Corrodes metals. • Reacts with most metals to produce hydrogen gas, which is flammable and explosive. • Can react with many substances to generate highly toxic products. Reactions may be violent. • Possible carcinogen and particularly hazardous substance. • OSHA Permissible Exposure Limit (PEL) is 1 mg/m³ over 8 hours. • For more information, see the SDS and the Lab Chemical Safety Summary for Sulfuric Acid.
	Selection & Purchase	<ul style="list-style-type: none"> • Purchase the smallest, shatter resistant containers (such as PVC-coated glass), at the lowest concentration possible. • Consider alternate methods and use a less dangerous acid if possible. • Buy inert absorbent or spill pads that can be used to absorb small spills of sulfuric acid.
Hazard Controls	Storage & Transport	<ul style="list-style-type: none"> • Store in secondary containment in a well ventilated area. • Store away from incompatibles such as organics, bases, halides, nitrates, chlorates, reducing agents, and others. • Transport in secondary containment, preferably a Polyethylene or other non-reactive acid/solvent bottle carrier. • Store below eye level but not on the floor. • Store away from metal and do not store under the sink.
	Engineering Controls	<ul style="list-style-type: none"> • Eyewash/drench hose is required in immediate work area. • For large quantities a safety shower will also be needed. • Work in a clean chemical fume hood free of incompatible materials.
	Work Practice Controls	<ul style="list-style-type: none"> • When diluting, add acid to water slowly, in small amounts. (Never add water to acid!) • <i>Work with the smallest practicable amount and lowest practicable concentration.</i> • Decontaminate work area by wiping it down with a soap and water solution.
	Personal Protective Equipment (PPE)	<ul style="list-style-type: none"> • Wear closed-toed shoes and clothing covering the legs. • Minimum PPE: <ul style="list-style-type: none"> ○ Buttoned lab coat ○ Safety goggles ○ 5 mil NEOPRENE gloves or 2 pairs of 4 mil NITRILE gloves for 10 - 30 minutes of protection. Change immediately if splashed. • Risk of splash/work with >100 ml add: face shield, impervious apron & sleeves (or coverall). • For expected glove contact use gloves rated for > 60 minutes with sulfuric acid (e.g., laminate or butyl). • Wash hands at time of glove change.
	Emergencies	<ul style="list-style-type: none"> • See Emergency Response webpage or flip chart and/or lab specific chemical hygiene plan. • For clean-up of <i>small</i> spills (<200 ml), wear butyl or laminate gloves and neutralize with sodium carbonate from edge to center, then absorb with inert material. Do not use combustible materials such as saw dust to absorb sulfuric acid spills!
Other	Waste	See lab-specific chemical hygiene plan, Lab Chemical Waste Management Practice , and Drain Disposal Practice . DO NOT MIX sulfuric acid waste with incompatible wastes (e.g., organics)!!!
	Training	Sign signature page in 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 SULFURIC ACID



Supplements the Guidelines for Safe Use of Sulfuric Acid

Lab	PI Name	Click or tap here to enter PI Name		
	Location	Enter building(s) and room(s) where lab is located		
Lab-Specific Hazard Controls	Purchase Details	Maximum container size	Enter maximum container size purchased	
		Maximum concentration	Enter maximum concentration purchased	
		Container type	Enter the container material Purchase in PVC coated or HDPE "poly" bottle if possible	
		Specific product information	Enter supplier name/product number or purity/grade to purchase	
	Storage	Specific location	Enter rooms and areas designated for storage	
	Use Information	Designated work area (specific room(s) and area(s))	Enter rooms and areas designated for use	
		Maximum quantity	Enter maximum quantity to be used at a time	
		Gloves (Note other PPE requirements in Guidelines)	If glove contact is NOT anticipated <input type="checkbox"/> 5 mil NEOPRENE gloves OR <input type="checkbox"/> 2 pairs of 4 mil NITRILE gloves	If glove contact IS anticipated <input type="checkbox"/> Laminate OR <input type="checkbox"/> Butyl
		PPE Storage Location	Enter location where specific PPE above is stored (e.g. specialized gloves, sleeves, apron, etc.)	
	Waste Information	Location of supplies for spill clean-up	Enter location of spill supplies (sodium carbonate and inert absorbent)	
Details about waste (location, type of container)		Enter location of waste container, type of container used		
Details of Process	1. Enter steps used in lab process(es) or experiment(s)			