

Standard Operating Procedure
for work with

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| Chemical name/class: <u>Nitric Acid</u> | CAS #: <u>7697-37-2</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 Oxidizers</u> | |

1. **Circumstances of Use:**

Nitric acid is typically used in SMIF for wet chemical etching or cleaning.

2. **Potential Hazards:**

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

Be aware of these specific hazards:

- **Nitric Acid is a very strong oxidizer**
- Oxidizers can ignite or react explosively with both organics and inorganics. Never mix oxidizers with solvents
- Nitric acid is corrosive and can cause severe skin burns and serious eye damage. It can also burn mucosal membranes, and the respiratory tract.
- Nitric Acid is considered particularly hazardous because of its oxidizing properties. It must never be mixed with organic materials such as solvents or acetic acid

3. **Engineering Controls:**

- Always work with Nitric Acid 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).
- 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:**

- Nitric acid must be stored in secondary containment
- Wear the designated PPE (section 5) when transporting an Nitric acid to a chemical hood.

7. **Waste Disposal:**

Liquid Waste

Pour all Nitric 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 Nitric 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:**


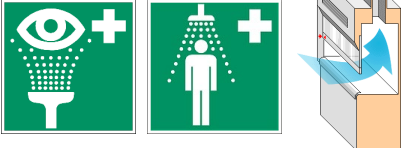

- All personnel are required to complete the SMIF General Lab Safety session and the SMIF Chemical Safety and Wet Hood training session.
- All personnel shall read and fully adhere to the ***Wet Hood Operating Procedure*** and the ***SMIF Lab Safety and Procedures Manual***



Duke OESO Guidelines for Safe Use of NITRIC ACID



Complete **Lab-Specific Safety Information** on page 2

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|------------------------|--|--|
| Hazards | Potential Hazards | <ul style="list-style-type: none"> Very strong oxidizer: can ignite or react explosively with both organics and inorganics. Concentrated nitric acid can release vapors and toxic gases (including NO₂) Corrosive. Burns skin, eyes, mucosal membranes, and respiratory tract. OSHA Permissible Exposure Limit (PEL) is 2 ppm over 8 hours. For more information, see the SDS and the Lab Chemical Safety Summary for Nitric Acid. |
| | Selection & Purchase | <ul style="list-style-type: none"> Purchase the smallest, shatter-resistant containers at the lowest concentration practical (less than 70% if 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 nitric 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 and combustibles as well as bases, 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 and safety shower are required in immediate work area. Work in a clean chemical fume hood that is free of organics and other incompatibles. Keep the sash lowered while reactions are in progress.  |
| | Work Practice Controls | <ul style="list-style-type: none"> Work should be done in a way that avoids hand/glove contact with nitric acid. When diluting, add acid to water slowly, in small amounts. (Never add water to acid!) 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 (Change immediately if splashed) Note that nitric acid penetrates lab nitrile gloves in <5 minutes. Lab neoprene (5 mil) gloves last 10–30 minutes. Risk of splash/work with >100 ml add: face shield, impervious apron & sleeves (or coverall), and gloves rated for nitric acid (e.g., 16–18 mil neoprene gloves). 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 (<100 ml), neutralize with sodium carbonate from edge to center, then absorb with inert material. Do not use combustible materials such as saw dust to absorb nitric acid spills! |
| Other | Waste | See lab-specific chemical hygiene plan, Lab Chemical Waste Management Practice , and Drain Disposal Practice . DO NOT MIX nitric 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

NITRIC ACID



Supplements the Guidelines for Safe Use of Nitric Acid

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| Lab | PI Name | Mark Walters | |
| | Location | Fitzpatrick CIEMAS - SMIF Cleanroom and Sample Prep | |
| Lab-Specific Hazard Controls | Purchase Details | Maximum container size | Enter maximum container size purchased |
| | | Maximum concentration | Enter maximum concentration purchased Order 70% or lower when possible |
| | | 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 | Acid Chemical Cabinet |
| | Use Information | Designated work area (specific room(s) and area(s)) | Acid Chemical Hood |
| | | Maximum quantity | Enter maximum quantity to be used at a time |
| | | PPE Storage Location | Enter location where specific PPE is stored (e.g. neoprene gloves, sleeves, apron, etc.) |
| | | Location of supplies for spill clean-up | Enter location of spill supplies (sodium carbonate and inert absorbent) |
| | Waste Information | Details about waste (location, type of container) | Enter location of waste container, type of container used DO NOT mix with organic waste! |
| Details of Process | 1. Enter steps used in lab process(es) or experiment(s) | | |