Nitric Acid

Standard Operating Procedure

Revision Date: 05/12/22

Laboratory Director (LD) Approval is Required Prior to Performing this Procedure

This standard operating procedure (SOP) outlines the handling and use of nitric acid. 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 nitric acid.

# Description [Provide additional information as it pertains to your research protocol]

Nitric acid is a very strong oxidizer that can ignite on contact or react explosively with many organic and inorganic substances. The MIOSHA permissible exposure limit (PEL) for nitric acid is 2 ppm (5 mg/m3) as an 8-hour time-weighted average.

## Process [Write the steps for using the chemical in your research protocol]

# Potential Hazards [Provide additional information as it pertains to your research protocol]

* Contact with easily oxidizable substances (including many organic substances such as acetone, acetonitrile, various alcohols, dichloromethane, DMSO, and many others) may result in fires or explosions.
* Nitric acid also reacts violently with many inorganic substances including various bases, reducing agents, ammonia, and alkali metals, among others. Many reactions will yield toxic gases, including nitrogen dioxide (NO2).
* Concentrated nitric acid can release vapors and toxic gases (including NO2), which can cause moderate to severe health effects, especially irritation to the eyes, skin, respiratory tract, and other mucosal membranes.
* If concentrated nitric acid contacts the skin, it can cause severe burns. Dilute concentrations that contact skin can cause mild irritation.
* Contact with eyes can cause severe burns and permanent eye damage.
* If high concentrations of nitric acid are inhaled, severe respiratory irritation can develop, along with possible delayed effects such as pulmonary edema, which can be fatal.
* Though not likely, ingestion of nitric acid can cause severe corrosion and burning of the mouth, esophagus, and stomach. As little as 10 ml of ingested nitric acid can be fatal.

# Engineering Controls [Provide additional information as it pertains to your research protocol]

An eyewash and safety shower must be available in the immediate work area for any work with nitric acid.

When working with nitric acid, always work in a clean fume hood that contains NO organic materials with the sash closed while reactions are in progress.

If mists are generated either mechanically or from vapor, work must be performed in a chemical fume hood to avoid inhalation.

# Work Practice Controls [Provide additional information as it pertains to your research protocol]

Designate an area for working with nitric acid (e.g. fume hood).

Work should be done in a way that avoids hand/glove contact with nitric acid; it should be noted that nitric acid penetrates standard nitrile gloves in 5 minutes or less. If gloves come in contact with nitric acid through a splash (or otherwise) they should be removed and changed immediately. Once work with nitric acid is complete, decontaminate the area by wiping it down with a soap and water solution.

Always use containers/glassware free from organic materials (and other incompatibles) for work with nitric acid.

# Personal Protective Equipment [Provide additional information as it pertains to your research protocol]

Goggles, lab coat, closed-toe shoes, double gloves (nitrile) or chemical resistant gloves (approved for contact with nitric acid) if there is an increased risk of glove contact. If neoprene gloves are available, they offer better protection than nitrile.

Face shield and acid-resistant apron are recommended if working with a larger volume (>200ml).

Latex gloves are NOT recommended for work with nitric acid (they offer little to no protection due to easy chemical penetration).

If contact with gloves is unavoidable, gloves rated for work with nitric acid must be used. Thicker neoprene gloves typically have the best glove ratings for prolonged nitric acid exposure. Refer to the Environment, Health & Safety (EHS) [Glove Compatibility Chart](http://ehs.umich.edu/research-clinical/planning-safe-research/glove-compatibility-chart/) Web page on the EHS website or the individual glove manufacturer’s website.

# Transportation and Storage [Provide additional information as it pertains to your research protocol]

* Nitric acid should be stored in in a well-ventilated area that is separated from organics and other combustible materials and incompatibles. Containers should be below eye level and in secondary containment.
* Store away from metal (unless the metal has a corrosion-proof coating), and do not store under the sink.
* Avoid storing on the floor.
* Ensure primary and secondary containment is free from organic chemicals/solvents.
* Transport corrosives in secondary containment, preferably a polyethylene or other non-reactive acid/solvent bottle carrier.

# Waste Disposal [Provide additional information as it pertains to your research protocol]

Handle and store nitric acid wastes following the guidelines above while accumulating wastes and awaiting chemical waste pickup. 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, unless authorized by EHS Hazardous Materials Management (HMM)**. Contact EHS-HMM at (734) 763-4568 for waste containers, labels, manifests, waste collection and for any questions regarding proper waste disposal. Also, refer to the EHS [Hazardous Waste](http://ehs.umich.edu/haz-waste/) Web page for more information.

# Training of Personnel

All personnel shall read and fully adhere to this SOP when handling nitric acid.

# Certification

I have read and understand the above SOP. I have received approval from my Lab Director to perform this procedure. I agree to contact my Lab Director if I plan to modify this procedure.

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### Major Revisions (Tracking purposes only -- Do not print as part of SOP)

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| Date | Revision |
| 09-19-18 | Updated EHS name and logo and format and revised the Exposure/unintended contact section (AKJ) |
| 02-25-19 | Updated links (DML) |
| 05-12-22 | Removed emergency response information (LGS) |