# University of Arizona

## Nitric acid Standard Operating Procedure

*[This is a template. Fill in all necessary blanks and delete all highlighted areas when complete. Add any sections necessary for your laboratory. This will be appended to your Laboratory Chemical Hygiene Plan.]*

**Title:**  **Click here to enter the title of your SOP.**

**Approval Holder (AH):** Click here to enter text **Approval #:** Click here to enter text

**Approval Holder Phone Number(s):** Click here to enter text

**Approval Safety Coordinator (ASC):** Click here to enter text

**Approval Safety Coordinator Phone Number(s):** Click here to enter text

**Department:** Click here to enter text

1. **Purpose**

This standard operating procedure (SOP) is intended to provide guidance on how to safely store, handle, use, and dispose of nitric acid at the University of Arizona’s laboratory. Laboratory personnel should review this SOP, as well as the appropriate Safety Data Sheet(s) (SDSs), before Describe the procedure or process this SOP will address. If you have questions concerning the requirements within this SOP, contact your Approval Holder (AH) or Approval Safety Coordinator (ASC).

1. **Scope**

*[Describe when this SOP applies and to whom this SOP applies.]*

1. **Hazard Description**

*[Describe the hazards presented by the procedure or process this SOP addresses. What makes it hazardous? Provide an example, if applicable.]*



Nitric acid - HNO3 (also known as *aqua fortis*) is a corrosive acid and strong oxidizing agent, which may intensify fire. Fire conditions may cause the formation of hazardous nitrogen oxides. It can react violently with organic chemicals such as organic solvents. It may be harmful if ingested, inhaled, or absorbed through the skin. It can cause severe skin and eye burns resulting in irreversible damage. It is extremely destructive to the tissue of the mucous membranes and the upper respiratory tract. Other symptoms include burning sensation, coughing, wheezing, shortness of breath, headache, nausea, vomiting, and pulmonary edema. Effects may be delayed. Large doses may conversion of hemoglobin to methemoglobin, producing cyanosis or a drastic fall in blood pressure, leading to collapse, coma, and possibly death. Chronic exposure may cause erosion of the teeth, jaw necrosis, and kidney damage. If you prepare aqua regia (mixture of HNO3: HCl at 1:3 ratio), a separate SOP is required.

1. **Process & Hazard Controls**

*[Describe the steps needed to set up and complete the procedure or process in safe manner following the* [*hierarchy of controls*](https://www.cdc.gov/niosh/topics/hierarchy/default.html)*. Use as much detail as is necessary to ensure all laboratory workers can complete the procedure or experiment safely.]*

* 1. **Elimination/Substitution**

*[Describe any eliminations of hazardous chemicals or processes; alternatively, any substitutions with less hazardous alternatives that could be used to accomplish the task.]*

* When possible, use a substitution to nitric acid such as hydrochloric acid or sodium bisulfate
  1. **Engineering Controls**

*[Describe any engineering controls (e.g. fume hoods, gas cabinets, local exhausts, blast shields, etc.) that are used to safely accomplish the task.]*

* **Fume hoods:** Use fume hood to keep exposure to nitric acid as low as possible.
  1. **Work Practices**

*[Describe any work practices (e.g. staggering schedules, additional cleaning measures for particulates, etc.) that are used to safely accomplish the task.]*

* 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.
* Never boil or heat nitric enough to cause evaporation into duct work. If nitric acid heating is required, contact RLSS for a hazard assessment and to determine appropriate control measures.
  1. **Personal Protective Equipment**

*[Describe the personal protective equipment needed to adequately protect laboratory workers when performing the process or procedure addressed by this SOP. Ensure to specify any personal protective equipment beyond the minimum (i.e. safety glasses, lab coat, gloves, long pants and closed-toed shoes).]*

* **Hand and Arm Protection**: Elbow-length, acid resistant gloves should always be used when creating, working with, or cleaning up. Two-sets of chemical-resistant gloves (e.g., nitrile) should be worn (“double-gloving”). A heavy-duty glove, such as butyl rubber, Viton, or equivalent, is recommended, especially when handling concentrated nitric acid or more than 1L. Nitrile gloves are NOT recommended for nitric acid.
* **Face and Eye Protection**: Safety goggles are required for the use of nitric acid. A face shield is highly recommended.
* **Body Protection**: A 100% cotton lab coat should be used and can be combined with an acid resistant apron to prevent exposure to the body.
* **Respiratory Protection**: Respirators may be required if exposures are not able to be adequately controlled by the use of engineering controls or other means. All uses of respiratory protection require RLSS assessment and consultation (for assessment of work, selection of respirator and filtration, and OSHA-mandated medical clearance and fit testing). Contact [rlss-ppe@arizona.edu](mailto:rlss-ppe@arizona.edu) with any questions or concerns.
  1. **Transportation and Storage**

*[Describe how to safely transport and/or store (e.g. ventilated cabinet, flammable cabinet, under inert blanket, etc.) the hazardous chemical(s) or processes.]*

* Keep container tightly closed in a dry and well-ventilated area, away from direct sunlight.
* Opened containers must be carefully resealed and stored upright to prevent leakage.
* Always store nitric acid in secondary containment.
  + Note: Nalgene/polypropylene tray or a tub is the best suited secondary containment.
* Containers holding nitric acid need to be stored below eye level.
* Store nitric acid away from flammable and combustible materials.
* Incompatibles include reducing agents, bases, alkali metals, cyanides, powdered metals, and organic materials (including organic acids and solvents).

1. **Spills, Cleanup & Disposal**

*[Describe how to safely end the procedure or process, clean up the process or spills, and/or dispose of any waste generated.]*

**Spills**

Spill response should always follow the [University Chemical Hygiene Plan](https://rgw.arizona.edu/sites/default/files/cs-univeristy_chemical_hygiene_plan.pdf) Section 8.2. Please find general guidance below:

* Minor spills in well-ventilated should be neutralized immediately with sodium bicarbonate or other acid neutralizer.
* Major spills or spills in poorly ventilated areas require evacuation of the laboratory; evacuate and call 911.

**Exposure Response**

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| --- | --- | --- | --- |
| **Inhalation** | **Ingestion** | **Skin Contact** | **Eye Contact** |
| May irritate the respiratory tract.  Conscious persons should be assisted to an area with fresh, uncontaminated air.  Seek medical attention in the event of respiratory irritation, cough, or tightness in the chest.  Symptoms may be delayed. | Rinse mouth. Do not induce vomiting. Seek medical attention immediately. | May cause skin burns.  Flush the skin with copious amounts of water for at least 15 minutes.  Seek medical attention immediately. | Aqua Regia is corrosive and irritating to the eyes.  Flush contaminated eye(s) immediately with copious quantities of water for at least 15 minutes.  Seek medical attention immediately. |

* **Disposal**: Nitric acid waste should never be combined with organics or reducing agents. The best practice is to store all nitric acid-containing waste streams in a dedicated container segregated from all other waste streams.

1. **Enter Additional Section Title**

*[Add as many sections as necessary to adequately describe how to safely perform the procedure or process addressed by this SOP.]*

1. **References:**

* <https://pubchem.ncbi.nlm.nih.gov/compound/Nitric-acid>
* <https://www.cdc.gov/niosh/npg/npgd0447.html>
* <https://betastatic.fishersci.com/content/dam/fishersci/en_US/documents/programs/education/regulatory-documents/sds/chemicals/chemicals-n/S25449.pdf>
* <https://www.ehs.washington.edu/resource/nitric-acid-sop-685>
* <https://www.umflint.edu/sites/default/files/groups/Environment__Health___Safety/SOP_PDF/nitricacid.pdf>
* <https://rgw.arizona.edu/sites/default/files/cs-univeristy_chemical_hygiene_plan.pdf>