

Standard Operating Procedure

Nitric Acid

Type of SOP: Process Hazardous Chemical Hazardous Class

Purpose

Nitric acid (also known as aqua fortis) is an extremely corrosive acid and strong oxidizing agent. 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. The main use of nitric acid is in the production of agricultural fertilizers. Its other uses include the production of nylon precursors, explosives, and rocket fuel.

Physical & Chemical Properties/Definition of Chemical Group

CAS#: 7697-37-2

Class: **Corrosive, strong acids**

Molecular Formula: HNO_3

Form (physical state): Liquid

Color: Colorless, light yellow

Boiling point: 83.9-100 °C

Potential Hazards/Toxicity

Nitric acid is an oxidizer that may intensify fires. Fire conditions may cause formation of hazardous nitrogen oxides. Nitric acid may be harmful if inhaled, ingested, or absorbed through the skin. It is extremely destructive to the tissue of the mucous membranes and upper respiratory tract. Causes severe skin and eye burns. May cause blindness and permanent eye damage. Inhalation may cause spasms, inflammation and edema of the bronchi or larynx, and pneumonitis. Other symptoms include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea, vomiting, and pulmonary edema. Effects may be delayed. Large doses may cause 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.

Engineering Controls

NOTE: Lab-specific information on engineering controls may be included in the Protocol/Procedure section.

Work with concentrated nitric acid should be conducted in a fume hood unless other controls are designated in the Protocol/Procedure section. Sash height should be kept low to minimize escaping fumes and provide a physical barrier.

Personal Protective Equipment (PPE)

NOTE: Lab-specific information on PPE selection may be included in the Protocol/Procedure section.

Respirator Protection

NOTE: Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

Refer to <http://www.ehs.washington.edu/ohsresp/index.shtm> for information about obtaining a respirator, getting it properly fitted and training necessary for its use.

Respirators should be used only under any of the following circumstances:

- As a last line of defense (i.e., after engineering and administrative controls have been exhausted).
- When Permissible Exposure Limit (PEL) has exceeded or when there is a possibility that PEL will be exceeded, and the material has adequate warning properties (e.g., odor or taste).
- Regulations require the use of a respirator.
- An employer requires the use of a respirator.
- There is potential for harmful exposure due to an atmospheric contaminant (in the absence of PEL)
- As PPE in the event of a chemical spill clean-up process

Lab personnel intending to use/wear a respirator mask must be trained and fit-tested by EH&S. This is a regulatory requirement.

Hand Protection

Handle with gloves. Viton gloves are recommended. **Nitrile gloves are not recommended for concentrated (>70%) nitric acid according to the Ansell Chemical Resistance Guide.** Gloves must be inspected prior to use. Use proper glove-removal technique (without touching glove's outer surface) to avoid skin contact with this material. Wash and dry hands.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with nitric acid. Lab-specific information on glove selection may be included in the Protocol/Procedure section.

For glove selection, go to: <http://www.ehs.washington.edu/ohs/updatestipsgloves.shtm>

Refer to glove selection chart from the links below:

http://www.ansellpro.com/download/Ansell_8thEditionChemicalResistanceGuide.pdf

OR

<http://www.allsafetyproducts.biz/page/74172>

OR

<http://www.showabestglove.com/site/default.aspx>

OR

<http://www.mapaglove.com/>

Eye Protection

Use safety glasses with side shields or tightly fitting safety goggles. Use face shield (8-inch minimum) over goggles when appropriate. Use equipment for eye protection tested and approved under appropriate government standards such as ANSI Z87.1, NIOSH (US), or EN 166(EU).

Skin and Body Protection

Long pants, closed-toed and closed-heeled shoes, cotton-based clothing/attire (no skin exposed below waist), and a **flame resistant lab coat** must be worn for protecting against chemical hazards. Use of a safety apron is also recommended for additional protection.

Hygiene Measures

Avoid contact with skin, eyes and clothing. Wash hands before breaks and immediately after handling the product.

First Aid Procedures

Notify supervisor and EH&S immediately following completion of first aid procedures.

1. During business hours (M-F/8-5) call 206-543-7262.
2. Outside business hours call 206-685-UWPD (8973) or 911* on campus phone to be routed to the EH&S staff on call.

If serious accident, hospitalization or fatality occur, notify EH&S immediately after providing first aid and/or getting help.

For all incidents and near misses, the involved person or supervisor completes and submits the Online Accident Reporting System (<http://www.ehs.washington.edu/ohsoars/>) form to EH&S within 24 hours (8 hours if serious injury or hospitalization).

If inhaled

Move person into fresh air. If not breathing, give artificial respiration. Call **911**. Consult a physician.

In case of skin contact

Wash off with soap and plenty of water for at least 15 minutes and remove contaminated clothing. Consult a physician.

In case of eye contact

Rinse thoroughly with plenty of water for at least 15 minutes lifting upper and lower eyelids and removing contact lenses. Consult a physician. Continue rinsing eyes during transport to hospital.

If swallowed

Do not induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

Special Handling and Storage Requirements

NOTE: Lab-specific information on handling and storage may be included in the Protocol/Procedure section.

Working alone Certain extremely hazardous operations should not be performed if the PI or Lab Safety Contact(s) are not present. Never work alone with extremely hazardous materials/operations. See the Protocol/Procedure section below for specific prohibitions (if any) on working alone.

Precautions for safe handling: Avoid contact with skin, eyes, and clothing. Avoid inhalation and ingestion. Keep away from heat and sources of ignition- No smoking.

Conditions for safe storage: Keep container tightly closed in a dry and well-ventilated area. Store in original container away from direct sunlight. Opened containers must be carefully resealed and stored upright to prevent leakage. Store away from combustible materials. Avoid alkali metals, reducing agents, cyanides, aldehydes, powdered metals organic materials, ammonia, acetic anhydride, acetonitrile, alcohols, and acrylonitrile.

Spill and Accident Procedure

Chemical Spill - Dial 911

Spill – Assess the extent of danger. Help contaminated or injured persons. Evacuate the spill area. Avoid breathing vapors. If possible, confine the spill to a small area using a spill kit or absorbent material. Keep others from entering contaminated area (e.g., use caution tape, barriers, etc.).

Small (< 1 L) – If you have training, you may assist in the clean-up effort. Use appropriate personal protective equipment and clean-up material for chemical spilled. Double bag spill waste in clear plastic bags, label and take to the next chemical waste pick-up.

Large (>1 L) – Dial 911 for assistance.

Chemical Spill on Body or Clothes – Remove clothing and rinse body thoroughly in emergency shower for at least 15 minutes. Seek medical attention. *Notify supervisor and EH&S immediately.*

Chemical Splash Into Eyes – Immediately rinse eyeball and inner surface of eyelid with water from the emergency eyewash station for 15 minutes by forcibly holding the eye open. Seek medical attention. *Notify supervisor and EH&S immediately.*

Medical Emergency Dial 911

Life Threatening Emergency, After Hours, Weekends And Holidays – Dial 911 or go to the nearest emergency room. Note: All serious injuries must be reported to EH&S within 8 hours.

Non-Life Threatening Emergency – Get medical care as soon as possible (<https://www.ehs.washington.edu/chs/ehc.shtm>). After hours go to the nearest emergency room. Note: All serious injuries must be reported to EH&S within 8 hours.

Needle stick/puncture exposure (as applicable to chemical handling procedure) – Wash the affected area with antiseptic soap and warm water for 15 minutes. For mucous membrane exposure, flush the affected area for 15 minutes using an eyewash station. Get medical care as soon as possible (<https://www.ehs.washington.edu/chs/ehc.shtm>). After hours, go to the nearest emergency room. Note: All needle stick/puncture exposures must be reported to EH&S within 8 hours.

Decontamination/Waste Disposal Procedure

NOTE: Lab-specific information on decontamination/waste disposal may be included in the Protocol/Procedure section.

Wearing proper PPE, decontaminate equipment and bench tops using soap and water. Dispose of the used chemical and contaminated disposables as hazardous waste following the guidelines below.

General hazardous waste disposal guidelines:

Label Waste

Label all containers (<https://www.ehs.washington.edu/epowaste/hazwastelabel.shtm>). See <https://www.ehs.washington.edu/epowaste/chemwaste.shtm> for general instructions on procedures for disposing of hazardous waste.

Dispose of Waste

- Dispose of regularly generated chemical waste within 90 days
- Call EH&S with questions

Protocol/Procedure

Nitric acid is a reagent used in organic reactions, and is a strong, corrosive acid and oxidizing agent.

Researchers should wear flame resistant lab coats, gloves, and safety goggles or glasses when handling nitric acid.

All work with concentrated nitric acid should be done inside a fume hood.

As a reagent, nitric acid may be used in quantities of <1mL up to 1L, and across a wide range of temperatures.

When working with concentrated nitric acid, it is important to make sure the work area is free of any bases and these may react violently with the acid.

It is also common to prepare dilute solutions of nitric acid for use as reagents, or for working up organic reactions.

When diluting nitric acid with water, the concentrated nitric acid should be added slowly to cooled water to minimize the exothermic nature of the reaction and any dangers from splashing.

Any solutions which contain nitric acid should be disposed of as hazardous waste after reactions are complete.

Nitric acid should be stored in a secondary container inside a designated corrosive cabinet.

Nitric acid should be stored in a separate area from any bases due to the danger of an exothermic reaction if allowed to mix.

As an oxidizing agent, nitric acid should be kept separate from organics that are flammable.

NOTE

Any deviation from this SOP requires approval from PI.

Documentation of Training

Name:	Title:
Signature:	Date:
Laboratory PI:	Location:

- Prior to conducting any work with nitric acid, designated personnel must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures.
- The Principal Investigator must provide his/her laboratory personnel with a copy of this SOP and a copy of the SDS provided by the manufacturer.
- The Principal Investigator must ensure that their laboratory personnel have completed appropriate laboratory safety training and are current with any refresher training required.

[Laboratory Name]

Documentation of Training

Standard Operating Procedure for [chemical]

Name	SOP Training Date	Signature
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