

Standard Operating Procedure

Nitric Acid

This SOP is not complete until it has been signed and dated by the PI and relevant lab personnel.

Print a copy and insert into your
Laboratory Safety Manual and Chemical Hygiene Plan.
Refer to instructions for assistance.

Department:	Chemistry & Biochemistry - Chemical Engineering
Date SOP was written:	December 14, 2012
Date SOP was approved by PI/lab supervisor:	January 18, 2013
Principal Investigator:	Prof. Susannah Scott
Internal Lab Safety Coordinator/Lab Manager:	Stephanie Goubert-Renaudin
Lab Phone:	805-893-8941.
Office Phone:	805-893-7403
Emergency Contact:	EH&S 24 hour line: 805-893-3194 (Name and Phone Number)
Location(s) covered by this SOP:	ESB 3324 and 3328 (Building/Room Number)

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, oxidizer

Molecular Formula: HNO₃

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.

Personal Protective Equipment (PPE)

Respirator Protection

Use a full-face respirator with multi-purpose combination (US) respirator cartridges as a backup to engineering controls. If the respirator is the sole means of protection, use a full-face supplied air respirator.

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.
- 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.

NOTE: Consult with your preferred glove manufacturer to ensure that the gloves you plan on using are compatible with nitric acid.

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

ANSI approved, tight-fitting safety glasses/goggles.

Skin and Body Protection

Lab coat, long pants, and closed-toe shoes.

Hygiene Measures

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

Engineering Controls

Chemical fume hood. Good ventilation.

First Aid Procedures

If inhaled

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

In case of skin contact

Wash off with soap and plenty of water for at least 15 minutes while removing 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

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 9-911 and EH&S (805-893-3194)

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 **9-911** from campus phones (and 805-893-3446 from a cell phone) and EH&S (893-3194) 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 **9-911**

Life Threatening Emergency, After Hours, Weekends and Holidays – Dial **9-911** (or 805-893-3446 from a cell phone) or go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *Note: All Serious injuries must be reported to EH&S within 8 hours.*

Non-Life Threatening Emergency – Go to the Student Health Building, Building 588 (phone number: 893-5361, hours: M, T, R, F 8am-4.30pm, W 9am - 4.30pm, R 5pm to 7pm by appointment). After hours go to the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) *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. Page the needle stick nurse \ and then enter your extension. After hours go to the nearest emergency room: the Emergency Room of Goleta Valley Cottage Hospital at 351 South Patterson Avenue, Goleta (Phone number: 805-967-3411) . *Note: All needle stick/puncture exposures must be reported to EH&S within 8 hours.*

Decontamination/Waste Disposal Procedure

Wearing proper PPE, please decontaminate equipment and bench tops. Call EH&S (805-893-3194) if assistance is needed. Dispose of the used nitric acid and disposables contaminated with nitric acid as hazardous waste.

General hazardous waste disposal guidelines:

Label Waste

- Affix an on-line hazardous waste tag on all waste containers using UCSB EH&S website as soon as the first drop of waste is added to the container

Store Waste

- Store hazardous waste in closed containers, in secondary containment and in a designated location
- Waste must be under the control of the person generating & disposing of it

Dispose of Waste

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

- Empty Containers
 - Dispose as hazardous waste if it once held extremely hazardous waste (irrespective of the container size)
 - Consult waste pick-up schedule

Prepare for transport to pick-up location

- Check on-line waste tag
- Write date of pick-up on the waste tag
- Use secondary containment

Safety Data Sheet (SDS) Location

SDS can be found online: <http://ehs.ucsb.edu/units/labsfty/labrsc/chemistry/lchemmsdsacc.htm>

Protocol/Procedure

In our Group, concentrated Nitric acid (70 w/w%) is stored in the designated 'Acid' ventilated storage cabinet and is used to prepare diluted solutions.

Concentrated nitric acid cannot be handled out of the ventilated fume hood, and has to be used on a cleared space away from any strong base, reducing agent and metals.

Due to its corrosive properties, Viton gloves have to be worn all the time, as well as a safety goggles and a lab coat. Gloves have to be changed when contaminated.

Due to the exothermic nature of the reaction, dilution of nitric acid has to be done by slowly adding the acid to water to limit the risk of splashing concentrated acid out. Nitric acid is also incompatible with flammable organic chemicals.

Nitric acid has to be disposed as a hazardous waste in the appropriate acidic waste container. Make sure the waste container contains no oxidizable organic material, such as acetic acid.

NOTE: Any deviation from this SOP requires approval from PI.

Documentation of Training (signature of all users is required)

- Prior to conducting any work with nitric acid, designated personnel, i.e. approved users listed below, 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 attended appropriate laboratory safety training and are current with any refresher training as required by EH&S.

I have read and understand the content of this SOP:

Name	Signature	Trainer	Date
Prof. Susannah Scott			
Stephanie Goubert-Renaudin			
Gary Kwanyi Ng			
Alessandro Gallo			
Anthony Crisci			
Haibo Yu			
Taeho Hwang			
Bethany Wigington			
Daniel Coller			
Zachary Jones			
Youhong Wang			
Jinghong Zhou			
Jason Fendi			