Laboratory Specific Standard Operating Procedures

TITLE: SOP for the safe use of Nitric Acid

Date: **7/20/18** Review: Date Revised:

Principal Investigator:

Authors (Names):

Department, Building, Room(s):

Contact Phone Number:

This SOP must be kept on file for all laboratory employee training and review.

Section 1: (Check One)
There are three methods that can be used to write SOPs. They are: by process (distillation, synthesis, chromatography, etc.); by individual hazardous chemical (benzene, phenol, arsenic, etc.); and by hazardous chemical class (flammable, corrosive, oxidizer, etc.).

_____ Process ___X__ Chemical _____Hazard Chemical Class

Section 2: Describe Process, Hazardous Chemical or Hazard Class
This SOP presents guidelines and procedures for the safe use of nitric acid (CAS #7697-37-2) and its solutions. In addition to use of this SOP, persons working with nitric acid should be thoroughly familiar with general guidelines for high hazard chemicals identified in the High Hazard Chemical Policy (EHS 200.09) and all other applicable LSUHSC chemical safety policies. All current applicable Safety Data Sheets (SDSs) should be available and reviewed prior to use.

Nitric acid is a very strong mineral acid and oxidizer with the chemical formula HNO_3. The primary use of nitric acid is in agricultural fertilizers. However, it can be used for the manufacture of explosives, the synthesis of other chemicals, and the production of nylon precursors.

Nitric acid is also known as: *aqua formis (which is Latin for strong water), azotic acid, engraver's acid, nital, hydrogen nitrate, and spirit of niter*.

Section 3: Potential Hazards
Physical Hazards

- Nitric acid is typically a liquid ranging from colorless to light yellow.
- It is a strong oxidizer that may intensify a fire.
  - Fire conditions can create nitrogen oxides.
- Will sublime (pass directly from solid to vapor and back to solid) readily at room temperature

and significantly when refrigerated.
- Highly corrosive, especially to metals.
- Incompatibilities and reactivities: acids, metals, excess heat, bases, combustible materials, hydrogen chloride, reducing agents, and strong oxidizing agents.

Health Hazards
- Acute toxicity of nitric acid is high.
- Nitric acid can be a severe irritant which can progress to chemical burns, by all exposure routes.
- Death can result from ingestion, inhalation, or skin absorption.
- Material is extremely destructive to the eyes, skin, and tissues of mucous membranes and upper respiratory tract.
- Contact with the eye can permanent damage to the cornea, iris, or conjunctive. Symptoms may include redness, tears, pain, burns, and blurred vision.
- Contact with the skin can lead to yellow staining, redness, pain, serious skin burns, and blisters.
- Inhalation can cause coughing, wheezing, shortness of breath, pulmonary edema, chemical pneumonitis, spasm, inflammation and edema of the bronchi, spasm, inflammation and edema of the larynx, pneumonitis, pulmonary edema, and bronchitis.
- Ingestion may cause vomiting, nausea, diarrhea, abdominal pain, kidney damage, and burns to the mouth, throat, and gastrointestinal tract.
- Symptoms of poisoning include: a burning sensation, coughing, wheezing, shortness of breath, headache, nausea, vomiting, pulmonary edema, and laryngitis. Effects may not immediately present.
- Chronic exposure can lead to chronic bronchitis, erosion of the teeth, lesions of the skin, bronchial irritation, coughing, pneumonia, and long damage.
- Nitric acid is regarded as a substance with poor warning properties.
- Nitric acid has not shown to be carcinogenic or to show reproductive or developmental toxicity in humans.

An employee demonstrating symptoms which might be a result of exposure to nitric acid shall report immediately to their supervisor whom shall request an evaluation by EH&S.

Section 4: Personal Protective Equipment
- Proper Laboratory Attire - pants or dresses/shorts/skirts below the knees, sleeved shirt, and closed-toe shoes.
- Lab Coat - fully buttoned lab coat with sleeves extending to the wrists. Coat may be reused before laundering if it has not been contaminated with nitric acid.
- Chemical Apron – a synthetic chemical apron can be utilized in conjunction with a lab coat to maximize protection.
- Eye / Face Protection
  - Splash goggles are required for all circumstances of use.
  - Ordinary (street) prescription glasses do not provide adequate protection.
  - A face shield in conjunction with goggles are recommended for best protection.
- Hand Protection
  - Wear chemically resistant gloves. Neoprene gloves are recommended for use with nitric acid. Practice good chemical hygiene and change gloves frequently and when contaminated, punctured or torn.
  - Nitrile gloves **DO NOT** provide protection.

- Laboratory personnel should thoroughly wash hands with soap and water before and immediately upon removal of gloves.
- Respiratory Protection - EH&S (568-6585) should be contacted prior to initial use (and when processes of use change) of nitric acid to evaluate exposures and need for respiratory protection.

Refer to EHS-400.03, Personal Protective Equipment for more information.

Section 5: Engineering Controls

- Substitute with a different chemical if practicable.
- Nitric acid should be purchased in the minimum concentrations necessary to mitigate hazards.
- Dilute nitric acid as much as practicable.
- Exhaust ventilation or other engineering controls should be utilized to keep the airborne concentrations of vapors below their respective threshold limit value.
- All nitric acid solutions must be prepared and handled in a certified chemical hood.
  - Remove all incompatibles within this work area.
  - Use of a Biological Safety Cabinet is especially not appropriate for working with nitric acid.
- Work at least 6" inside of hood and set sash at lowest possible position.
- The working surfaces of any hood for which nitric acid is used should be protected with plastic backed absorbent pads to ensure containment of any spills. The side and back walls shall be covered to a minimum height of 12"
- Any hood for which nitric acid is used shall have a warning sign posted that identifies the hazards and necessary controls.
- Ensure an Emergency Wash Station is available for use.

Section 6: Special Handling and Storage Requirements

- Pure nitric acid and concentrated solutions should be secured from unauthorized access.
- Store pure nitric acid and its concentrated solutions in appropriate, sealed containers within an unbreakable secondary containment. **Note** – never use metal containers as a means of containment. Label all containers, including secondary containment, with the chemical name and hazard warning.
- Avoid contact with nitric acid including vapors.
- Ensure the area is cool and well ventilated. Also use appropriate respiratory protection.
- Keep away from all sources of ignition.
- Do not store near combustible materials.
- Avoid incompatibles such as: heat sources (including direct sunlight), oxidizing agents, reducing agents, combustible materials, metals, alkalis, and alcohols.
- When moving pure nitric acid to a chemical hood, do not remove it from secondary containment until it is in the hood.
- Prepare the smallest amount of solution necessary for the procedure.
- When nitric acid is heated it will decompose to toxic fumes.
- Never add water to nitric acid. Instead slowly pour acid into water while mixing thoroughly.
- Prior to conducting any work with nitric acid, the Principal Investigator must provide training to his/her laboratory personnel specific to the hazards involved in working with this substance, work area decontamination, and emergency procedures, to include review of this SOP and applicable SDS.

Section 7: Spill and Accident Procedures

- The availability, location, and contents of chemical spill clean-up kits must be confirmed prior to handling or beginning any work with nitric acid.
- Immediately notify all lab personnel of spills (with the details of the spill and actions being taken) and regulate access, as necessary, to the area.
- Laboratory personnel should be prepared to respond to spills in accordance with the guidance provided in LSUHSC Chemical Spill Response Procedure (EHS 200.02).
- All spills of nitric acid should have personnel contact University Police.
- Personnel cleaning the spill shall, at minimum, wear the same PPE required for handling/use.
  - Heavy rubber boots and gloves are recommended along with a self-contained breathing apparatus.
- Do not touch the spilled material.
- Do not breathe mist, vapor, or spray and ensure adequate ventilation.
- Keep away from sources of ignition and eliminate all sources of ignition.
- Prevent entry to sewer system and public waters.
- Evacuate all personnel from the immediate area.
- Spill procedures
  - Utilize a dry, inert material to absorb.
  - Neutralize spill with sodium bicarbonate.
  - A vapor suppressing foam may be used to reduce vapors.
  - Prevent further leakage if safe to do so.
  - Dispose of the neutralized mixture as hazardous waste as directed in Section 9.
  - After all spills have been absorbed and the area confirmed to be neutralized, wash with soap and water solution to complete decontamination.
- All exposed persons should seek immediate medical attention (subsequent to initial decontamination for skin contact).
- Spill volumes less than approximately one liter can be cleaned by lab personnel with assistance from EH&S by using absorbent pads (found in chemical spill kits) and placing in an appropriate waste disposal container.
- Spill volumes greater than approximately one liter shall be cleaned-by EH&S (personnel should immediately evacuate the area and contact University Police for spills greater than one liter).
- Do not attempt to clean spills if you feel unsure of ability to complete safely.
- Report all spills, regardless of size, to laboratory PI, who will report to LSUHSC EH&S.

Incident and accident reporting must be done electronically via the on-line fillable forms located on the EHS website. For more information about appropriate form selection, refer to EHS-400.06, Incident and Accident Reporting and Investigation Policy.

Section 8: Decontamination Procedures

- Where the eyes or body of any person may be exposed to nitric acid, a safety shower/eye wash must be available for immediate use. Personnel must be aware of location of nearest Safety Shower/ Eye Wash and verify that a current certification of performance tag is present.
- Personnel shall rinse any areas of skin and/or eyes exposed by nitric acid with copious amounts of water for at least 15 minutes.
- If exposed to nitric acid, obtain medical attention immediately.
- Whereas inhalation has occurred, transport the victim to a fresh air environment. If breathing is labored, provide oxygen. If breathing ceases, administer artificial respiration. Obtain medical assistance immediately.

- If ingested, do not induce vomiting. Rinse mouth with water. Do not give anything by mouth to an unconscious individual. If conscious and alert, provide 2-4 cupfuls of milk. Ingestion may cause severe swelling, as well as severe damage to delicate tissue and danger of perforation.
- All equipment, materials and work surfaces that have/potentially have become contaminated with nitric acid shall be thoroughly cleaned with soap water solution prior to storage and re-use.

Section 9: Waste Disposal Procedures

Nitric acid waste is considered hazardous and must be disposed of in accordance with LSUHSC Chemical Waste Management Procedures (EHS 200.04).

- Waste storage – waste should be placed in a tightly sealed container and labeled with the words "HAZARDOUS WASTE" clearly marked, the primary constituents of the waste, and the starting accumulation date.
- To schedule a waste pick-up by EH&S, use the bob.lsuhsc.edu service request system.

Section 10: Laboratory Specific Protocol(s):

Attach laboratory protocol for specific handling and operational practices.