

## Standard Operating Procedures for Hazardous Chemicals

- **Title of Procedure:** Nitric Acid Dilutions for Flame AA
- **Date:** 3/29/2012
- **Date of Last Review:**
- **Principal Investigator:** Benny Freeman
- **Lab Location:** PRC building 133, Lab 5.512
- **Lab Personnel who have reviewed SOP/Date:**
  - Joseph Cook/3-29-2012
  - K Stevens/3-20-2012

### Risk Assessment

#### Hazardous Chemicals:

99% Nitric Acid (HNO<sub>3</sub>) (also called Fuming Nitric Acid)

#### Potential Hazard(s):

- 1) Extremely Corrosive
- 2) Oxidizer. Do not store near flammable chemicals or with other acids/bases.
- 3) Exposure to high concentrations of nitric acid vapor may cause pneumonitis and pulmonary edema which may be fatal. Symptoms may or may not be delayed. Continued exposure to the vapor & mist of nitric acid may result in a chronic bronchitis, & more severe exposure results in a chemical pneumonitis.
- 4) Can cause severe burns to eyes and skin. Rapidly produces fumes which can cause respiratory tract burns.

#### Routes of Exposure:

Inhalation, eye contact, skin contact.

#### Quantity/Concentration Hazards:

OSHA Vacated PELs: Nitric acid: 2 ppm TWA; 5 mg/m<sup>3</sup> TWA

#### Substitution of Less Hazardous Chemicals:

For the purposes of Flame AA analysis, there is no substitute unless specifically recommended by the FlameAA manufacturer.

### Control Measures

#### Personal Protective Equipment (PPE):

While handling non-dilute fuming nitric acid, the following must be worn at all times:

- 1) Heavy chemical gloves.

- 2) Lab Coat.
- 3) Safety Glasses.

While handling dilute (~2%) nitric acid, the following must be worn at all times:

- 1) Nitrile or latex gloves.
- 2) Lab Coat.
- 3) Safety Glasses.

#### **Engineering Controls:**

- 1) Non-dilute nitric acid must be in a vent hood when it is not sealed close.
- 2) Procedures with nitric acid must be performed in a vent hood with plenty of space with no other chemicals near the acid, and absolutely no flammable chemicals in the vent hood at all.
- 3) Do not use any metal components with nitric acid.

#### **Work Practice Controls:**

- 1) Care should be taken not to spill nitric acid, especially if not diluted
- 2) Procedures with nitric acid should not be performed alone.

#### **Monitoring:**

n/a

#### **Cleanup Procedures:**

Nitric acid containers should be resealed and stored immediately after the initial dilution.

#### **Storage Procedures:**

Nitric acid containers will be stored in a separate, sequestered container within the acid storage cabinet. Expiration dates will be checked every 6 months, and expired acid disposed of through EHS.

#### **Transportation Procedures:**

Concentrated nitric acid will not be transported outside of the lab. At dilute concentrations (~2%) it may be transported between labs while being carried in a chemical carrier/tub.

#### **Waste Disposal Procedures:**

When properly followed, standard operating procedures should prevent the generation of excess fuming nitric acid, though there will usually be excess dilute (~2% or less) nitric acid. Waste nitric acid will be poured into an acid-safe container (set aside for nitric acid only) and turned into EHS for disposal.

#### **Emergency Procedures:**

Note – before using any nitric acid make sure there is a readily available container of sodium bicarbonate (high-purity not required).

**Spills or Releases:** In the event of a spill, immediately cover the spill with an excess of sodium bicarbonate. Sweep/wipe up the sodium bicarbonate and dispose of in a separate solid waste container that does not contain any flammable material. Dilute (2% or less) nitric acid may be wiped up with a paper towel.

**Fire:**

- Not flammable or combustible, but is an oxidizer for flammable chemicals
- Suitable extinguishing media: Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.
- Special protective equipment for firefighters: Wear self-contained breathing apparatus for firefighting if necessary.
- Hazardous decomposition products formed under fire conditions. - nitrogen oxides (NO<sub>x</sub>)
- Use water spray to cool unopened containers.

**Emergency Shut Offs:** n/a

**Signs and Symptoms of Exposure:** Irritation, inflammation or burning of the exposed area.

**Exposures:**

- Eyes: Get medical aid immediately. Do NOT allow victim to rub eyes or keep eyes closed. Extensive irrigation with water is required (at least 30 minutes).
- Skin: In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Get medical aid immediately. Wash clothing before reuse.
- Ingestion: If swallowed, do NOT induce vomiting. Get medical aid immediately. If victim is fully conscious, give a cupful of water. Never give anything by mouth to an unconscious person.
- Inhalation: POISON material. If inhaled, get medical aid immediately. Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen.
- Notes to Physician: Treat symptomatically and supportively.

**Occupational Health Requirements:**

n/a

**Material Safety Data Sheets (MSDS):**

MSDS is available in the lab in the notebook near the door. Also attached to this document

**Training Requirements:**

Personnel must be trained by observing a demonstration of the procedure in the lab by a trained person, and then repeat the procedure under observation.

### **Review of Procedure:**

Procedure should be reviewed once per year.

### **Protocol:**

#### Creating the ~2% nitric acid solution.

You will need a 1L volumetric flask with a stir bar, and 50 mL glass or plastic graduated cylinder, and a container with ~1L of deionized (DI) water.

- 1) Put on all required PPE.
- 2) Set the graduated cylinder on the floor of the fume hood, do not hold it during the procedure to prevent spilling on yourself (a ring stand may be used to hold the cylinder if necessary).
- 3) Add ~0.5L of DI water to the flask.
- 4) Carefully pour ~20 mL of nitric acid into the graduate cylinder (the Flame AA does not require an exact concentration of nitric acid, so approximately 20 mL will be sufficient).
- 5) Pour the ~20 mL nitric acid into the volumetric flask containing ~0.5 L DI water
- 6) Seal the nitric acid bottle and return it to storage.
- 7) Fill the volumetric flask with water until there is 1L of solution.

Diluting the Flame AA samples.

You will need at least one graduated pipette (with disposable tips) several 15 mL centrifuge tubes, a waste container, and two beakers (about 200 – 500 mL). Label one beaker “Rinse” and one “Draw” (or other appropriate labels) so as not to confuse them.

- 1) Put on all required PPE.
- 2) Fill both beakers half to 2/3 full of the 2% nitric acid solution (note you will still have much nitric acid left in your 1L flask; this can be used to refill the beakers as needed, or stored for future use in the nitric acid storage cabinet).
- 3) Remove the cap of a centrifuge tube and place it upright in a beaker or some other stable holder on a mass balance. Tare the balance.
- 4) Add the aqueous sample to be diluted/measured to the centrifuge tube and record the mass (you should be recording the mass of the sample only).
- 5) Secure a pipette tip on the end of the pipette. Draw a measured amount of nitric acid (at least as much as will be used as your diluent) from the “Rinse” beaker, then eliminated it into the waste container to rinse the tip.
- 6) Draw a measured amount of nitric acid from the “Draw” beaker, then inject it into the centrifuge tube. Record the mass (do not tare the balance in between adding the sample and adding the diluent acid; you should be recording the mass of the sample, then the mass of the sample + diluent).
- 7) Repeat steps 3-6 for as many samples as needed.
- 8) Pour any remaining nitric acid solution from the “Rinse” and “Draw” beakers into the waste container, then dispose.