Working with Nitric and HF Blends

1) Preparation - Before any worked uses Nitric and HF Blends they should do the following:
    a. Read and fully understand the Safety Data Sheet (SDS) for Nitric and HF Blends.
    b. Read this document and fully understand it.
    c. Review or create a Standard Operating Procedure (SOP) for the process in which Nitric and HF Blends is used) due to hazardous levels of Hydrofluoric Acid (HF) being found in the Nitric and HF Blends), incorporating information contained in this document.
    d. Obtain a Calgonate first aid kit from www.calgonate.com and review the first aid procedures therein.
    e. Obtain a Calgonate spill kit from www.calgonate.com and review the procedures to follow in the event of a spill.
    f. Contact your Environmental Health & Safety officer, or NuGenTec with any questions.
2) Designated Area:
    a. Nitric and HF Blends should always be handled inside of a fume hood or, under forced ventilation, with a sign stating “Danger, Hydrofluoric Acid Used in this Area”.
    b. The SOP should be posted or readily available near the designated area.
    c. First Aid:
        i. A tube of 2.5% calcium gluconate gel from Calgonate (consider several tubes if large volumes of Nitric and HF Blends are present) or Zephiran solution must be present. Each Calgonate first aid kit contains two tubes of 2.5% calcium gluconate gel.
        ii. The gel should be replaced annually (the expiration date is clearly marked on the tube).
    d. An HF spill kit should be nearby.
    e. Ensure you have ready access to a good supply of running water and know the location of the safety shower and eyewash.
3) Personal Protective Clothing:
    a. Laboratory coat and acid resistant apron.
    b. Close toed shoes and long pants.
    c. Goggles and full face shield.
    d. Vapor respirator.
    e. Gloves:
        i. Use gloves that cover the hands, wrists and forearms. Use gloves made from butyl rubber, **Neoprene rubber**, Viton®/butyl rubber, **Barrier®(PE/PA/PE)**, Silver Shield/4H®(PE/EV AL/PE), **Trellchem® HPS**, Trellchem VPS, Tychem® SL (Saranex®), Tychem® CPF3, Tychem® BR/LV, Tychem® Responder, **Tychem® TK**. Preferred glove selection is highlighted in bold.
4) Safe Processing Practices
    a. Never work with Nitric and HF Blends alone or after hours.
    b. Nitric and HF Blends reacts with glass, which should never be used to store or transfer it. Use chemically compatible containers, such as those made from polyethylene or Teflon.
    c. Ensure all containers of Nitric and HF Blends are clearly labeled.
    d. Ensure Nitric and HF Blends containers and tanks are securely supported and not likely to tip over.

    e. Keep tanks and containers covered when not in use, or under forced ventilation when in use to prevent inhalation of vapors.
5) Transporting Nitric and HF Blends - If a Nitric and HF Blends containing solution must be transported from one area to another:
    a. Place the Nitric and HF Blends in a clean, chemically compatible container and close the lid.
    b. Have a coworker (also wearing proper personal protective equipment) open doors and handle objects for you and to not contaminate surfaces with Nitric and HF Blends.
6) Managing Nitric and HF Blends Containing Waste:
    a. Waste Nitric and HF Blends should be placed in a chemically compatible container that is clearly labeled with a Hazardous Waste tag and that is compliant with all chemical plant waste container policies (e.g. secondary containment, closed cap, etc.).
    b. Dispose of Nitric and HF Blends containing hazardous waste containers following the usual hazardous waste disposal procedures.
    c. Contact your Environmental Health and Safety Officer with any questions.

<u>First Aid</u>

Symptoms of HF exposure are often delayed for several hours. If you suspect you may have been exposed to HF contained in the Nitric and HF Blends but are not experiencing any immediate symptoms, apply immediate first aid nonetheless. A quick response can substantially reduce injury.

No person exposed to Nitric and HF Blends should be allowed to go home or return to work without having seen a doctor who is aware of the nature and extent of the exposure.

Prevent cross contamination: the victim of HF exposure should perform the following actions on him/herself whenever possible. Anyone who provides assistance should use the proper gloves, and other personal protective equipment mentioned in this document, in order to prevent contaminating themselves. Do not use latex gloves; they do not provide an effective barrier against chemicals, especially Nitric and HF Blends.

Skin exposure:

1) Immediately flush affected areas with cold running water (shower if available). While flushing, remove all contaminated clothing as well as jewelry that could trap Nitric and HF Blends. Wash the contaminated area with copious amounts of running water for 5 minutes. Speed and thoroughness in washing off the acids is essential. If calcium gluconate gel (2.5%) is not available, continue flushing with water for at least 15 minutes or until medical treatment is given.
2) While the victim is being rinsed with water, someone call 911 and say (a) a person has been exposed to hydrofluoric acid and nitric acid. (b) The person can be found at [give location of victim]. (c) Please send an ambulance.
3) Don a new pair of chemical resistant gloves (to prevent possible secondary HF burns) and massage calcium gluconate gel (2.5%) freely into the affected site. Apply the gel as soon as the washing is done. The affected area does not need to be dried first. The gel will turn white (CaF_2

precipitate) upon reaction with the acid. OR Soak the affected area in, or apply compresses of, iced Zephiran solution (0.13% aqueous solution of benzalkonium chloride).

4) After these actions have begun, re-examine the victim to ensure no exposure/burn sites have been overlooked.
5) Calcium gluconate gel (2.5%) should be re-applied, or Zephiran soaking repeated, every 10-15 minutes until the ambulance arrives or a physician/EMT gives medical treatment.
6) Provide the following information to the EMS team, and/or physician: (a) The concentration of hydrofluoric acid and Nitric Blends from the SDS. (b) Date, time of exposure, duration of exposure, and how exposure occurred. (c) Body parts affected or exposed, and the percent of body surface area affected. (d) Summary of first aid measure given, including when calcium gluconate gel or Zephiran was first applied, the body areas to which the treatment was applied, and how many times the treatment was applied in total.

Eye exposure:

1) Immediately flush eyes with cool flowing water, preferably at an eyewash station, or sterile eyewash solution. Hold the eyelids open and away from the eye during irrigation to allow thorough flushing of the eyes. If sterile 1% calcium gluconate solution is available, start using it within the first 5 minutes (via continuous drip into eyes), and continue using it as the preferred flushing agent (Do NOT use 2.5% calcium gluconate GEL on the eyes). If sterile 6 1% calcium gluconate solution is not available, wash with copious amounts of water for 15 minutes while holding eyelids apart.
2) While washing the eye, have someone call 911 for emergency medical assistance, preferably an eye specialist. Calcium gluconate solution (1%), eyewash, clean water, or ice water compresses should be used to continue to irrigate the eye(s) while transporting the victim.

Inhalation of Vapors

1) Immediately move affected person to fresh air and call 911 for medical assistance.
2) Keep victim warm, comfortable and quiet.
3) If breathing has stopped, begin CPR at once. Make sure mouth and throat are free of foreign material.
4) 100% oxygen (10 to 12 L/min flow rate) should be administered as soon as possible by a trained individual.
5) A nebulized solution of 2.5% calcium gluconate may be administered with oxygen by inhalation.
6) Do not give stimulants unless instructed to do so by a physician.
7) The victim should be examined by a doctor and held for observation for at least 24 hours. The reason is that inhalation of HF fumes may cause swelling in the respiratory tract up to 24 hours after exposure. A person who has inhaled Nitric and HF Blends vapors may require prophylactic oxygen treatment. Vapor exposure can cause skin and mucous membrane burns and damage to pulmonary tissue. Vapor burns to the skin are treated the same as liquid HF burns.

Ingestion:

1) Do not induce vomiting. Never give anything by mouth to an unconscious person.
2) Have the victim drink large amounts of room temperature water as quickly as possible to dilute the acids.

3) Call 911 for medical assistance.
4) Have the victim drink several glasses of milk or several ounces of milk of magnesia, Mylanta, Maalox or similar products, or eat up to 30 Tums, Caltrate or other antacid tablets. The calcium or magnesium in these substances may act as an antidote. Avoid administering bicarbonates at all costs, the carbon dioxide byproduct could severely injure the victim.
5) Proceed to a physician for appropriate follow-up and/or treatment.

Nitric and HF Blends Spills

If a major Nitric and HF Blends spills occur, follow the spill protocol described in your Environmental Health & Safety guide.

1) Alert nearby coworkers and evacuate to a safe distance.
2) If a fire, explosion, or toxicity hazard exists, pull the fire alarm and follow building evacuation procedures. A person familiar with the situation should greet firefighters when they arrive and provide the relevant Safety Data Sheets (SDS's).
3) If you have not pulled the fire alarm, close doors of affected areas and prevent re-entry. Put up "Do Not Enter" signs or barrier tape (should be available from your EH&S Officer and in HF spill kit).
4) Call the EH&S Officer to obtain assistance (they will contact the Fire Department).
5) Do not re-enter the area until instructed to do so by the Fire Department or emergency response personnel. If a minor spill occurs and you feel that you and your co-workers are capable of addressing the spill, follow the Minor Spill Protocol with the following modifications:
    a. Notify the EH&S Officer. The EH&S Officer can assist with the cleanup.
    b. Obtain a HF spill kit from your lab or from the EH&S Safety Officer and employ the HF neutralizer found therein. Only HF specific absorbents should be used to address an HF spill. If such absorbents are not available, a large excess of dilute, aqueous calcium or magnesium hydroxide can be employed. The neutralization should be performed slowly in order to avoid an exothermic reaction (heat will vaporize HF and increase the risk of exposure).

Do not attempt to neutralize Nitric and HF Blends with the following:

1) Sodium or Potassium Carbonate ("Soda Ash", "Caustic Soda"): The reaction of Na_2CO_3 or K_2CO_3 with HF generates sodium or potassium hydrogen bifluoride ($NaHF_2$ or KHF_2) as intermediates, which releases gaseous HF when exposed to heat.
2) Potassium or Sodium Hydroxide (found in many acid-neutralizing kits): The neutralization of HF with potassium or sodium hydroxide is more exothermic than with sodium or potassium carbonate and also generates potassium or sodium hydrogen bifluoride ($NaHF_2$ or KHF_2) as intermediates, which releases gaseous HF when exposed to heat.
3) Silicon-based absorbent materials (common in most solvent spill kits) react with HF to generate silicon tetrafluoride, which is a toxic and corrosive gas.