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Prepared By:	Approved By:	Approved By:
Keith Klaus	Andrew Ackerman	John Aloi

*Approval signatures on file with master copy.

This document presents the requirements for use of hydrofluoric acid at the NSLS after normal working hours.

General Hazard Analysis; Hydrofluoric acid

Hydrofluoric Acid (HF) can cause severe skin burns at almost any concentration. HF can penetrate the skin and cause deep tissue damage and interfere with systemic Calcium, Magnesium, and Potassium ion balance. Inhalation of vapors can result in severe lung damage. Contact with eyes is extremely damaging and painful.

HF burns are difficult to treat as the fluoride ion is aggressive and difficult to neutralize. First aid involves a complicated combination of flushing with water and use of calcium gluconate preparations and benzalkonium chloride solutions.

HF solutions have low vapor pressures, but at concentrations greater than 50% the solutions can ‘fume’. Below 50% no fuming occurs and so inhalation risk is reduced. HF solutions with concentrations less than 15% are considered ‘dilute’.

Common Experiment Use of Hydrofluoric Acid at the NSLS

Hydrofluoric acid is commonly used at NSLS to etch and clean silicon crystals and wafers. Dilute HF working solutions up to 15% are used for this process. Working solutions are prepared by diluting 48% HF reagent in water. Either that aqueous solution is used or it can be mixed with concentrated Nitric Acid to prepare a final etching bath.

The volume of the HF solution needed is dependent upon the size of the crystal being treated. For work on beam line optics, the crystals can be several centimeters in length, width, and height and as much as 500 ml working solution is needed. Experiment samples are usually much smaller (1 cm^3 or thin wafers with 1 cm^2 surface area) and require less than 100 ml of working solution.

All HF use at the NSLS is restricted to lab 2-190D where spill materials, PPE, and a supply of 2.5% Calcium Gluconate gel is kept.

Required Controls for all HF work.

Work Practices

- All HF work is controlled through procedure, work planning, or experiment safety review.
- Facility, beam line optics HF work must be completed during normal BNL business hours.
- Only Experiment work with HF may proceed outside of normal BNL business hours. Work within business hours is preferred, but it is recognized that experiments proceed at all hours and limited HF use may be needed at other times for experiments to succeed.
- All HF work is conducted in the laboratory exhaust hood in lab 2-190D. This lab is equipped with a safety shower, eye wash, and spill response kit with calcium gluconate gel.
- All HF workers must complete the following training:
    - LS-ES-002 Procedure for the acid etching of silicon and germanium crystals (read and sign).
    - Individual ESH orientation including hazards of hydrofluoric acid, proper spill response procedure, location of spill response equipment, and first aid response (personal discussion with NSLS ESH staff).
- All HF reagent (48%) containers must be no larger than 500 ml.
- All HF work is performed on acid spill pad to catch potential spills.
- Only non HF reactive receptacles rated to handle HF are used such as polypropylene containers and Teflon tongs.
- Pouring position must be ergonomic and solutions are transferred with care aimed at minimizing splashes.

PPE

- **Eye protection:** ANSI Z87.1 compliant, vented splash goggles are required and must be worn in conjunction with a chemical splash face shield.
- **Clothing:** Lab coat, long pants, long sleeve shirt, and fully enclosed shoes with socks are always required.

Additional Task Specific Requirements for Hydrofluoric Acid Use

Mixing working solutions; work with reagent HF (48%)

- **Hand protection;** Double gloves as follows:
  - Outer gloves: long cuffed neoprene rubber coated fabric BNL stock #K63180.
  - Inner gloves: disposable neoprene (Ansell NeoTouch or equivalent).

- **Clothing:** Acid resistant apron.

Using working solutions; work with HF solutions ≤ 15%, volumes ≤ 100 ml

- **Hand protection**; Disposable neoprene gloves (Ansell NeoTouch or equivalent) must be used. These gloves are rated for contact protection up to 20 minutes and must be removed and disposed upon contact with HF.

- **Clothing:** As described above for all HF use.

	REQUIREMENTS						
Operation	Safety Goggles & Face Shield	Disposable neoprene gloves (20 minute contact protection)	Gloves (Heavy neoprene outer; disposable neoprene inner gloves)	Chemical splash apron	Closed Shoes*	Long pants*	Long Sleeve Shirt or Lab Coat
Using Working Solutions	X	X			X	X	X
Mixing solutions using 48% HF.	X		X	X	X	X	X

* General Non-Office Area Requirement

Signature below indicates concurrence with above requirements for using hydrofluoric acid at NSLS after normal business hours in accordance with SBMS Subject Area requirements.

APPROVALS		
Name (Print)	**Signature**	**Date**
Ken Erickson, BNL Chemical Hygiene Officer		
Dr. Joseph Falco, BNL Occupational Medicine Clinic		
Andrew Ackerman, NSLS ESHQ Manager		