Fact Sheet

OSU ENVIRONMENTAL HEALTH & SAFETY

Safety Instruction

Hydrofluoric Acid (HF)

Purpose

Provide basic information about hydrogen fluoride gas/hydrofluoric acid (HF) to aid OSU researchers in establishing safe field and laboratory practices. This is guidance information only and should not be used as the sole source of worker training. All workers (Laboratory Supervisors, students, staff, and volunteers) that use HF shall follow laboratory-specific Standard Operating Procedures (SOPs) that describe training measures and use. SOPs shall be included in the laboratory's Chemical Hygiene Plan.

Emergency HF Exposure Procedure

NOTE: *OSU Student Health Services does not have the resources to respond to a HF exposure.*
Immediately call 911 in the event of an exposure.

Emergency Procedures for an exposure must be included in the laboratory's Chemical Hygiene Plan and all lab workers must receive training, with documentation, about those procedures.

Responsibilities

Supervisor

- Develop laboratory-specific SOPs. **NOTE:** This safety instruction, alone, cannot suffice.
- Develop an emergency response plan.
- Develop a spill response plan for both small and large spills. Ideally, EH&S should help respond to HF spills.
- Provide and document hazard and risk mitigation training for all workers working with or in near proximity to, HF.

EH&S

- Confirm annually that the Corvallis Good Samaritan Hospital has appropriate treatment for an HF exposure.

Training

Lab workers who handle HF shall be trained on safe handling techniques, what to do in the event of an exposure, and how to safely address a spill. This training must be documented and included with the laboratory specific Chemical Hygiene Plan. A Safety Data Sheet (SDS) on HF shall always be available in the immediate work area where HF is used.

OSU SDS Database: http://oregonstate.edu/ehs/sds

Chemical Properties

HF is a neutral lipid-soluble molecule that penetrates tissue more rapidly than typical mineral acids. HF is colorless, and its solutions are clear, colorless liquids. When exposed to air, concentrated solutions produce pungent fumes which are especially dangerous. Dilute concentrations of HF in water (e.g., less than 40% HF) do not produce significant vapor concentrations.

Health Hazards

Skin Contact: HF can cause serious, painful burns of the skin. Specialized first aid and medical treatment is required. Burns larger than 25 square inches (160 square cm) may result in serious systemic toxicity.
Systemic Toxicity: HF differs from other acids because the fluoride ion is readily absorbed by skin tissue. Unlike other acids which are rapidly neutralized, this process may continue for days if left untreated. One of the most serious consequences of severe HF exposure by any route is the marked lowering of serum calcium (hypocalcemia) and other metabolic changes, which may result in fatal outcome if not recognized and treated soon after exposure.
Inhalation: HF vapors or fumes will usually cause upper respiratory injury, with mucous membrane irritation and inflammation, as well as cough.
Ingestion: If HF is ingested, severe burns to the mouth, esophagus and stomach may occur. Ingestion of even small amounts of dilute HF has resulted in death.

Safety Practices

Chemical Fume Hood: The safest work space for working with HF is in a functioning fume hood. Before using the hood, check to see if it has been certified and is working properly. Perform all HF procedures on a plastic surface.

Gloves: HF readily penetrates skin and can become trapped under fingernails. Heavy neoprene or nitrile rubber gloves are best for working with HF. Increased thickness of

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gloves can decrease dexterity. Instead of wearing heavy material gloves workers can wear consecutive pairs of nitrile gloves which will provide increased protection with less reduction in dexterity.

OSU Glove Use Guide: http://oregonstate.edu/ehs/glove.

Body Protection: When working with HF, wear the proper clothing and personal protective equipment that provides protection in the event of a spill. Long pants, long sleeves, and closed-toe shoes are to be worn in all laboratory settings. Always wear a lab coat or chemical resistant apron to protect your from spills and splashes.

Eye Protection: Goggles, along with a face shield, should be worn when handling HF.

Team Work: Laboratory personnel shall work with a co-worker when handling HF. No one is allowed to work alone. Only personnel who are suitably trained can work with HF due to its extreme hazards.

Decontamination: Once finished handling HF, take off gloves without making skin contact. Then, thoroughly wash hands with soap and water. Protective clothing should not come into contact with bare skin when undressing.

Avoid exposure to HF: When working, pay close attention to the task at hand and do not allow yourself to become distracted. Contact with dilute HF solutions may not produce immediate pain but may result in severe burns without immediate treatment. All labs where HF is used should have calcium gluconate readily available. Calcium gluconate binds to HF and prevents it from penetrating deeper into tissue. Ensure your lab's stock of calcium gluconate has not expired. It has a relatively short shelf life.

Spill Management

All areas where HF is used must have a proper spill control kit. Small spills of low-concentration HF can be neutralized by covering the acid with spill control pads. For large or high concentration HF spills, evacuate all persons in the area and close all doors. Any type of accidental release of HF must immediately be reported to nearby laboratory personnel, as well as to EH&S.

OSU Chemical Spill Response guidelines: http://oregonstate.edu/ehs/sites/default/files/pdf/si/spill_response-chemicals_si.019.pdf

***NOTE:** Inexpensive chemical spill kits are available for purchase from Chemistry Stores in Gilbert Hall.*

Storage and Incompatibilities

HF waste shall be placed in a chemically compatible container (i.e. polyethylene or Teflon) with a sealed lid and official EH&S hazardous waste label (http://oregonstate.edu/ehs/waste). Glass, metal (other than some nickel alloys made specifically for use with HF), and ceramic containers are not compatible with HF. Always place HF containers on a low, protected shelf or other location where it will not be accidently spilled or knocked over. Many fluoride-containing chemicals (e.g., ammonium fluoride, sodium fluoride, sulfur tetrafluoride, and ammonium bi-fluoride) may react with acid or water to produce HF. If the manner in which the fluoride compound is used can create HF, follow the precautions for HF.

OSU Chemical Storage guidelines: http://oregonstate.edu/ehs/sites/default/files/pdf/si/chemical_storage_guidelines_si.pdf

Exposure Limits

ACGIH Threshold Limit Value (TLV): Listed as Hydrogen Fluoride

- 8-Hour Time Weighted Average (TWA): 0.5 ppm • Ceiling: 2 ppm
- Skin Notation
- Carcinogen: Not Listed
- TLV Ceiling value based on irritation (respiratory system, eyes, skin) with possible burns and effects to bone, teeth, and fluorosis.

OSHA Permissible Exposure Limit (PEL): Listed as Hydrogen Fluoride

- 8-Hour time Weighted Average (TWA): 3 ppm (2.3 mg/m^3)
- Ceiling: Not Listed

NIOSH Recommended Exposure Limit (REL):

- 8-Hour Time Weighted Average (TWA): 3 ppm (2.3mg/m^3)
- Ceiling: 6 ppm (5mg/m^3) (15-minute)
- Skin Notation: Not Listed
- IDLH VALUE: (Immediately Dangerous To Life and Health): 30 ppm

NOTE: A TWA concentration is for an 8-hour workday (ACGIH-TLV, OSHA-PEL) and up to a 10-hour workday (NIOSH-REL) during a 40-hour workweek. A Short-term Exposure Limit (STEL) value is a 15-minute TWA exposure that should not be exceeded at any time during a workday. A Ceiling value should never be exceeded for even an "instantaneous" exposure period.