



UNIVERSITY
OF WOLLONGONG
AUSTRALIA

UOW SAFE@WORK

HYDROFLUORIC ACID MANAGEMENT GUIDELINES

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1. Introduction

The University of Wollongong is committed to providing a safe and healthy workplace for all workers, visitors and students. To meet this commitment, the University shall endeavour to control any risk to workplace health and safety through the adoption of risk management principles into all work practices.

Hydrofluoric acid (HF) is a highly corrosive and toxic liquid. It should be handled with extreme care, beyond what is generally required to handle other mineral acids. Owing to its low dissociation constant, HF penetrates tissue more rapidly than typical mineral acids as it is a neutral lipid-soluble molecule. Because of the ability of hydrofluoric acid to penetrate tissue, poisoning can occur readily through exposure of skin or eyes, or when inhaled or ingested. Symptoms of exposure to hydrofluoric acid may not be immediately evident as it interferes with nerve function, meaning that burns may not initially be painful. Accidental exposures can go unnoticed therefore delaying treatment and increasing the extent and seriousness of the injury.

As a result, the University has put in place strict guidance surrounding purchasing, handling, storing and disposing of HF. The University of Wollongong is obligated to ensure any persons handling or being in an area where HF is used are without risk of exposure and comply with the safe work practices set out in this guideline.

2. Scope

This guideline is intended to provide a consistent approach to the management of HF across the University. Topics surrounding the management of HF covered by this document include training, purchasing, handling, storing, disposing and managing HF related emergencies.

All personnel who are intending to use HF need to be aware of the information set out in this guideline as well as their applicable responsibilities. Responsibilities

2.1. Heads of School or Directors of Units

Heads of School or Directors of Units are responsible for the approval of the use of HF in their areas and must approve any risk assessments and safe work procedures prior to use.

2.2. Supervisors and Members of Research Groups

Supervisors and members of research groups who are using HF must:

- plan work in the knowledge that any exposure may cause permanent incapacity or death
- ensure all personnel working in the laboratory containing HF are familiar with the properties and hazards of HF
- ensure all HF users are trained and deemed competent in the handling and using HF
- document a risk assessment for its intended use, prior to that use
- document and follow the appropriate safe work procedure
- undertake workplace inspections and competency assessment at least twice a year.

3. Risk Management

Every effort must be made to eliminate the use of HF. Investigation of alternate methods or use of alternative chemicals is recommended. If a substitute is not possible then a risk assessment must be completed in consultation with workers who could be exposed. A detailed risk assessment must be completed prior to the initial use and purchase of any solutions containing HF and must be approved by the relevant head of school or director of unit.

It is recommended that the number of people using HF be minimised within a laboratory. Use of HF by undergraduate coursework students is prohibited. Use of HF by research students requires approval on SafetyNet by the relevant Head of School or Director, and only after successful completion of the required theory and practical training. Approval of HF use on UOW premises can be withdrawn if procedures within this document or other health and safety procedures are not adhered to. Laboratory workers have the right to refuse to handle HF if they are uncomfortable or are not willing to accept the risk of using HF.

4. Purchasing

The following considerations are to be made when purchasing HF:

- prior to the initial purchase of HF, the safety data sheet for the specific concentration of HF being ordered must be read by the requestor and they must ensure that the recommended risk control measures are in place in their work area prior to the introduction of the material (e.g. working fume cupboard, Australian standard designed storage cabinets, recommended personal protective equipment, secondary containers for transport etc)
- a detailed risk assessment must be completed and attached to the purchasing requisition form for the order to be processed. This risk assessment needs to be approved by the relevant head of school or director of a unit. **Repeat purchases can use the same risk assessment if the HF is to be used for the same purpose**
- **ensure only minimum quantities of HF are purchased at one time just prior to required use.** Containers holding HF can degrade and should not be stored for long periods of time. Where practical smaller containers should be purchased to minimise decanting risks
- it should be clearly stated on the purchasing requisition form that **HF is to be delivered directly to the laboratory and not to the UOW or Faculty distribution office.** When placing an order it may be necessary to contact the Faculty purchasing office or suppliers to arrange direct delivery
- on arrival the container of HF should be clearly labelled with the arrival date
- storage and disposal considerations need to be identified during the purchasing process. Storage requirements are specified on the product SDS.

5. Competency and Training Requirements

HF is only to be handled by laboratory workers who have been adequately trained and assessed as competent in its use.

There 2 parts to the training and competency process for HF:

- **Part 1: Online HF Awareness Training** is to be completed by ALL laboratory workers who are working in a laboratory where HF is handled, even if they are not actually handling or using HF (laboratory workers are not permitted to work in a laboratory where HF is stored and used, unless they have completed the HF awareness training). This training involves a presentation followed by a competency assessment task in the form of a quiz. A 100% pass mark is required in the quiz before access to the relevant laboratory is granted.

- **Part 2: HF Use in the Laboratory** is a practical assessment based in the relevant laboratory. The [HF Use Competency Checklist](#) shall be used as a record of completing the practical assessment. The trainer describes and demonstrates the method to be used involving HF. The trainee must then successfully and safely complete the task based on the safe work procedure and is marked against specific required actions on the [HF Use Competency Checklist](#). The trainee is also shown and described the use of HF spills kits, HF first aid kits, HF scrubber fume-hood and other information as relevant to the specific laboratory and safe work procedure.

Depending on the frequency of use of HF, competency of the user must be reviewed at least twice a year against the [HF Use Competency Checklist](#). These checks should be documented and recorded in a training record. It is the responsibility of the Supervisor to monitor handling of HF by HDR students.

Competent trainers are essential when training laboratory workers in a new high risk procedure. There are no formal accreditation processes available for HF trainers, however, personnel who undertake HF training *Part 2: HF Use in the Laboratory* must be able to demonstrate extensive experience in using HF, specific to the task, a knowledge of UOW policies and procedures and have the skills and attributes to successfully train new users.

6. Procedures for Using and Handling HF

6.1. General Safe Work Practices

All activities involving HF must have a documented risk assessment and safe work procedure completed in SafetyNet prior to use that has been approved by the Head of School or Director. For all areas, there should be limited access to HF, with a minimum number of people required to handle this substance.

Anyone using HF must be trained and competent in its use and a second trained and competent person must always be in attendance, aware of the use of HF and be prepared to assist in the event of an emergency. The following are the general safe work practices that must be followed when using HF:

- all work should be conducted in a HF scrubber fume cupboard
- specimen storage areas must be marked as containing HF solutions
- solutions containing HF must be stored in polyethylene or Teflon containers as HF reacts with glass and solutions containing HF are incompatible with glass storage vessels and equipment
- eyewash stations, emergency showers and hand washing facilities must be available in each work area
- a first aid kit, which includes appropriate antidotes for potential exposure (eg skin contact, eye contact, inhalation) must be available in each work area
- an appropriate spill kit must be located in the lab where the HF is being used and stored
- laboratory space and placement of equipment should not create a crowded working environment nor inhibit cleaning
- all skin and eye contact must be avoided
- access to laboratories containing HF must be restricted to trained and competent persons
- waste containers for the safe disposal of acids and contaminated items must be provided & labelled to indicate concentration of HF
- **no persons are permitted to work alone with HF** or after 6.00pm, before 8.00am or on weekends or public holidays, when normal emergency assistance services, (eg, first aid, building wardens) are not available
- alert other workers in the laboratory that you are using HF and place signage to that effect either on the fume-hood sash or laboratory door. Always lower fume-hood sash when not working at the hood

- never add water to the acid. When performing dilution, HF should be added gradually to water. If using a dispenser it is preferable to add HF under the surface of the water in order to minimise the generation of HF vapour and splashes
- regular inspection and testing programs should include fume-hood function (integrity of scrubber, fume-hood surfaces, pH of tank water), first aid kit and spill kit, and safety shower and eyewash stations.

6.2. Personal Protective Equipment

There are specific Personal Protective Equipment (PPE) requirements for handling HF. It is essential that PPE be worn correctly and is regularly checked to confirm it is in good condition. No areas of skin should be exposed.

In addition to standard laboratory PPE (lab coat, chemically resistant enclosed shoes, long pants and sleeves), the following PPE is also recommended when working with HF:

- a face shield for handling and transferring HF
- safety glasses are suitable for concentrations less than 1% HF or where the likelihood of a splash is low (for example where less than 10 mL is being used) - **at concentrations greater than this or where there is a high likelihood of a splash safety goggles should be used**
- a PVC apron
- neoprene (most desirable) or PVC gloves, sleeve protectors or gauntlet style gloves and nitrile gloves worn underneath the outer glove. Double gloving is recommended and gloves should be regularly inspected and replaced as all glove materials eventually degrade in the presence of HF.

6.3. Transport and Storage

Handling and storage of HF requires special materials and technology for containers, pipes and valves etc. HF is highly reactive with most metals, glass, ceramics and fibreglass and should only be stored in polyethylene or PVC containers. All HF storage containers must be inspected regularly for any leaks or damage. **All containers and pipework must be clearly labelled. Containers must be labelled with the prepared/delivery date and HF concentration.**

HF should be stored in a secure area that is in a restricted, locked laboratory in a ventilated storage cupboard away from strong oxidising agents, organic compounds, metals and strong bases. It should also be stored in a cool, dry well-ventilated area away from heat and within a bunding tray (i.e. secondary container that can withhold the volume if primary container ruptures). **All Storage areas must be clearly labelled.** Ensure the storage location of HF is specified in ChemAlert laboratory stock inventory.

Solutions of HF should not be routinely transported out of or around a laboratory. If transport is required keep volumes to a minimum, ensure caps are secure and always use secondary containment. Never transport in squirt/wash/squeeze/spray bottles.

Transport between areas should be minimised and preferably restricted to moves required during refurbishments or relocation.

When transporting from another lab or area, ensure that:

- your route is planned so that there are NO obstacles or obstructions in your way
- all containers are banded in an appropriate container to contain any spills
- 2 people are present during the transport
- containers are tied down or secured so they will not fall off when using manual handling aids
- if using lifts ensure the transport of dangerous goods procedure is followed in line with the [Working with Hazardous Chemicals and Dangerous Goods Guidelines](#)
- a spill kit is readily available in case of an emergency

6.4. Labelling

All containers holding HF solutions and waste must be labelled in line with the [Working with Hazardous Chemicals and Dangerous Goods Guidelines](#). Labels can be printed from ChemAlert if required. Containers must be labelled with HF concentration and the delivery/prepared /use-by date. HF containers have a limited life span and should be inspected for degradation regularly.

It is recommended that HF containers are visually easy to identify. Placing red electrical tape around the container is a simple way to indicate high risk of HF containers in the lab.

6.5. Waste Disposal/Neutralisation

If HF is consumed within the reaction then residue solutions can be placed in normal laboratory waste containers. The pH of the waste from such procedures should be regularly checked to ensure it is above pH 7. Never recycle solutions.

6.5.1. Concentrated HF (>10% w/w and <50% w/w)

Small amounts (<100ml)

Small amounts of HF can be neutralised. Procedures for neutralising small amounts of HF are:

- all neutralisation must be performed in the appropriate fume hood for HF
- wear all PPE required for the use of HF
- slowly add neutralising agent (sodium bicarbonate or calcium carbonate) until the pH reaches 7
- dilute the neutralised solution with excess water and flush to drain.

If it is not possible to achieve a pH between 7 and 10, the solution should be disposed of following the procedures for large amounts.

Note: Only solutions that are not contaminated with residual metals are allowed to be disposed of down the drain.

Large amounts (>100ml)

Large amounts of HF should be collected in a dedicated HF residue container. This waste container should be clearly labelled with a [Miscellaneous Waste Disposal Identification Label](#) (noting both toxic and corrosive risks) and the [Waste Tracking Log](#) should clearly state the presence of HF. The waste is to be treated as a “waste chemical” and disposed of via the chemical waste store as per the [Laboratory Waste Disposal Guidelines](#).

The residue container should be segregated according to compatibility. Similarly, any solid waste (e.g. gloves) that may be contaminated with HF, should be segregated and disposed of separately as HF waste. Redundant stock of HF should be disposed. Do not store indefinitely.

6.5.2. Dilute HF (<10% w/w)

Follow procedure for small amounts of concentrated HF above.

6.5.3. Empty containers

Containers should be decontaminated if possible. Once the container is dry, the word DECONTAMINATED or RINSED should be clearly written on the label along with the DATE – this helps to confirm that the HF is no longer a hazard. The container can then be recycled following the [Laboratory Waste Disposal Guidelines](#).

If the container cannot be decontaminated (eg containers fitted with a septum requiring a syringe to extract HF), then it is to be treated as a “waste chemical” and disposed via the chemical waste store as per the [Laboratory Waste Disposal Guidelines](#).

7. Spill Management

Before attempting to clean any spills:

- always consider the need for evacuation when a spill occurs especially if vapours are being given off or if respiratory or eye irritation occurs
- always check yourself for any contamination especially your shoes. You do not want to spread HF around the laboratory or to other areas. Apply appropriate first aid measures if you have been exposed.
- avoid contact with liquid and inhalation of vapours
- never clean a spill on your own
- always wear all of the correct PPE
- ensure you have the right equipment and spill kit
- **never use any organic materials such as vermiculite, sand or kitty litter to absorb spills**

Method 1: For small volumes of HF <10mL (any concentration)

Note: If the HF is heated or excessively off-gassing method 2 should be used

Inside the fume hood	Outside the fume hood
<ul style="list-style-type: none"> ▪ Make a solution of calcium carbonate or sodium carbonate ▪ Absorb spill with paper towel ▪ Place paper towel in neutralizing solution and leave to soak. The paper towel may be disposed of as normal waste once it has been rinsed thoroughly. ▪ Wipe the spill area with paper towel soaked in calcium or sodium carbonate solution. This may need to be repeated several times to ensure complete neutralisation and removal of fluoride. 	<ul style="list-style-type: none"> ▪ Restrict access to the spill area ▪ Follow procedure for inside fume hood ▪ Check your shoes at the end of the process to ensure there has been no contamination

Method 2: For spills 10 to 500mL

Inside the fume hood	Outside the fume hood
<ul style="list-style-type: none"> ▪ All surfaces that may have been splashed will need to be cleaned thoroughly ▪ Contain spill by making a dam around spill using neutralising material ▪ Slowly cover spill with neutralizing agent ▪ Allow time for neutralization to occur ▪ Clean up material and dispose of as per the HF waste disposal procedures ▪ Wipe area down with water 	<ul style="list-style-type: none"> ▪ Restrict access to the spill area ▪ Take care not to step in or spread the spill ▪ Follow procedure for inside fume hood ▪ Check your shoes at the end of the process to ensure there has been no contamination

Method 3: For spills > 500mL

Inside the fume hood	Outside the fume hood
<ul style="list-style-type: none"> ▪ Consider the need for evacuation especially if the spill is concentrated HF ▪ Only experienced persons should attempt to clean large spills ▪ Restrict access to area ▪ For large spills you will need to ensure that the whole of the fume cabinet is decontaminated 	<ul style="list-style-type: none"> ▪ Evacuate and close off area ▪ Call security and any other relevant parties (Lab supervisor, lab manager and WHS unit) ▪ Follow procedure for inside fume hood ▪ For large spills you will need to ensure that the whole area is decontaminated ▪ Check your shoes at the end of the process to ensure there has been no contamination

For spill volumes above 2.5L call UOW Security on ext 4900 to request HAZMAT response

8. First Aid Response

For all routes of exposure, the severity and timing of adverse health effects are primarily dependent on the concentration of HF and duration of exposure. Medical assessment is required regardless of the severity of the exposure.

All research groups using HF must have:

- personnel trained in the correct first aid treatment for HF
- a HF first aid kit easily accessible within the laboratory, including antidotes such as hexafluorine, diphoterine, milk (preferably UHT), oral calcium gluconate (or other readily absorbed ionised calcium salt such as calcium phosphate, calcium carbonate or citrate), or calcium gluconate gel and a program to regularly check that they are within the ‘use by’ date (they must be discarded and replaced after the expiry date)
- safety showers and eye wash facilities in the laboratory where HF is used and a program to check regularly, with checks recorded on a placard behind the safety shower (if safety shower or eye wash is used, contaminated water should be treated as a “large spill outside the fume hood”).

Those administering first aid need to be protected from exposure to HF by wearing the appropriate PPE as recommended in the risk assessment.

For any exposure to HF, SEEK URGENT MEDICAL ATTENTION by calling 000 and Security on ext 4900.

The Safety Data Sheet must accompany the patient to hospital, along with calcium gluconate gel, hexafluorine, diphoterine, or other antidote.

Exposure	Health Hazards	IMMEDIATE First Aid Response
Skin contact	<p>Highly corrosive and toxic by skin contact. The acid is rapidly absorbed through the skin with toxic and potentially fatal effects. Skin contact produces deep and extremely painful burns, with destruction of underlying tissue.</p> <p>Absorption can decalcify bones and cause systemic toxic effects due to calcium and magnesium imbalance, because the HF binds to calcium and magnesium in the body. This can cause heart or other organ damage or failure.</p> <p>It has been estimated that skin exposure to concentrated HF over 2% of body area (about the size of a hand) can be fatal. Recovery from serious non-fatal burns may take a long time.</p> <p>Burns from strong solutions are felt immediately but weaker solutions spilled on the skin may not cause pain for several hours. Workers may have finished work and returned home before feeling pain and realising something is wrong.</p> <p>Fingernails not properly scrubbed can cause acid to be retained under the nails causing burns, absorption into the body and possible nail loss.</p>	<p>Flood affected area with hexafluorine 3-5 times to wash off all acid. If this is not available, flush with running water (preferably using a shower, otherwise a tap or hose) for at least 15 minutes.</p> <p>Remove contaminated clothing, shoes, watch, rings etc as quickly as possible while still flushing, using neoprene or PVC gloves to ensure no further contamination occurs.</p> <p>Make sure that the acid does not spread to other parts of the body or onto the rescuers.</p> <p>Scrub under nails if contaminated.</p> <p>If water has been used, apply calcium gluconate gel to the burns as soon as possible after drenching. Using neoprene or PVC gloves, gently rub the gel into the contaminated areas and continue to apply fresh gel every 15 minutes until medical help arrives.</p> <p>White specks appearing around the contaminated area indicate that the desired reaction has taken place.</p> <p>Note the time of application and inform emergency services.</p> <p>TRANSPORT TO HOSPITAL WITHOUT DELAY</p>

Exposure	Health Hazards	IMMEDIATE First Aid Response
Eye contact	<p>Hydrofluoric acid fumes can dry out the eyes and cause a burning sensation, redness and secretions. Splashing into the eyes may cause severe and irreversible damage to the cornea, including possible blindness. Splashing into the eyes with dilute HF may cause delayed burns.</p>	<p>Immediately hold eyelids apart and flush the affected eye for at least 15 minutes. Use hexafluorine if available, otherwise diphtherine, normal (isotonic) saline or running water. If only one eye is affected, make sure that contaminated water does not run into the other eye.</p> <p>Remove contact lenses if possible without causing further trauma.</p> <p>Continue flushing the eye during transport to hospital.</p> <p><i>Note: Calcium gluconate gel supplied for skin burns is NOT suitable for use in eyes.</i></p> <p>TRANSPORT TO HOSPITAL WITHOUT DELAY and consult an ophthalmologist (eye specialist)</p>
Inhalation	<p>Breathing in low vapour concentrations may irritate the nose and throat. High vapour concentrations can cause severe burns to the lips, mouth, throat and lungs. Fluid may accumulate in the lungs (pulmonary oedema) and this can lead to death. Effects on the lung may occur immediately or can be delayed for up to 36 hours, therefore affected individuals need complete rest and must be kept under medical observation even if no symptoms are (yet) manifested.</p>	<p>Take precautions to ensure the rescuer's safety (self-contained breathing apparatus may be required).</p> <p>Remove the affected person to fresh air.</p> <p>Oral calcium gluconate (or other readily absorbed ionised calcium salt such as calcium phosphate, calcium carbonate or citrate) should be taken if conscious and able to swallow.</p> <p>Give half to one cup of water, milk or calcium/ magnesium containing antacid to drink if conscious and able to swallow. Do not give large amounts of fluid or vomiting may occur.</p> <p>Apply artificial respiration if not breathing, preferably with a demand valve resuscitator, bag-valve mask, or pocket mask as trained.</p> <p>TRANSPORT TO HOSPITAL WITHOUT DELAY</p>
Ingestion	<p>If hydrofluoric acid is swallowed, burning of the digestive tract may occur, with bleeding, vomiting, diarrhoea and collapse of blood pressure. Perforation of the digestive system or organ failure due to calcium imbalance may lead to death.</p>	<p>Do not induce vomiting. If vomiting occurs naturally help the person to lean forward to reduce the risk of breathing in the vomit. Vomited material must be handled as contaminated i.e. Avoid contact; clean up immediately into double sealed bag.</p> <p>Rinse the person's mouth out with cold water.</p> <p>Oral calcium gluconate (or other readily absorbed ionised calcium salt such as calcium phosphate, calcium carbonate or citrate) should be taken.</p> <p>Give half to one cup of water, milk or calcium/ magnesium containing antacid to drink if conscious and able to swallow. Do not give large amounts of fluid or vomiting may occur.</p> <p>TRANSPORT TO HOSPITAL WITHOUT DELAY</p>

The above pages on Spill Management and First Aid Response should be printed and placed in the laboratory for quick reference in an emergency.

9. Related Documentation

- [Laboratory Waste Disposal Guidelines](#)
- [Incident Management and Reporting Guidelines](#)
- [Risk Management Guidelines](#)
- [Working With Hazardous Chemicals and Dangerous Goods Guidelines](#)
- [WHS Policy](#)
- [WHS Purchasing Guidelines](#)

10. Reference Material

- [NSW WHS Act 2011](#)
- [NSW WHS Regulation 2017](#)

11. Program Evaluation

In order to ensure that these guidelines continue to be effective and applicable to the University, these guidelines will be reviewed regularly by the WHS Unit in consultation with the WHS Committee.

Conditions which might warrant a review of the guidelines on a more frequent basis would include:

- reported hazards or injuries
- non-conforming systems
- WHS Committee concern.

Following the completion of any review, the program will be revised/updated in order to correct any deficiencies. These changes will be communicated via the WHS Committee.

12. Version Control Table

Version Control	Date Released	Approved By	Amendment
1	Sep 2012	Prof. Will Price, Dean of Science Prof. Chris Cook, Dean of Engineering Prof. Elena Pereloma, AIIM Mr Darren Smith, Manager WHS	Formation of document
2	July 2014	Manager WHS	Removed specific quantity restrictions for ordering HF from Section 3.3
3	April 2017	WHS Manager	Reviewed entire document
4	May 2019	WHS Manager	Clarified information on waste disposal and first aid procedures.
5	August 2019	WHS Manager	Clarified difference in requirements for coursework versus research students.