School of Earth & Environmental Sciences

HYDROFLUORIC ACID MANAGEMENT GUIDELINES

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1 Introduction / Background
Hydrofluoric Acid (HF) is an extremely hazardous material being toxic, corrosive and highly reactive. Exposure can cause death. There are strict regulatory requirements in the purchasing, handling, storage and disposal of HF solutions and as such the School of Earth & Environmental Sciences (SEES) is obligated to ensure all members of the School, with risk of exposure, comply with recommended codes of practice to mitigate risk.

2 Scope / Purpose
1 This policy is intended to:
   • Improve awareness of the hazards associated with working with HF;
   • Provide a consistent approach across the School on how HF is managed;
   • Promote best practice in the procuring, handling, storing and disposal of HF.

2 All members of the unit who are intending to use HF should be aware of the HF management procedure and their responsibilities and obligations.

3 Supervisors have the responsibility to ensure that all students and visitor’s within their research group and who may be exposed to HF are aware and abide by this policy.

4 The use of HF within SEES is subject to the conditions outlined below.

5 The policy is to be used in conjunction with relevant University Policies and agreements.

3 Roles and Responsibilities
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;
   • Document a risk assessment for its intended use, prior to that use;
   • Document and follow the appropriate safe work procedure;
   • Undertake workplace inspections at least twice a year.

All laboratory workers using HF must complete, prior to use, the University HF training. In this training HF users are given information on health effects, safe work procedures, personal protection, first aid and emergency procedures. Nomination forms for HF training can be found at:
http://staff.uow.edu.au/ohs/training/index.html

Laboratory workers, who are not actually handling HF, but are working in a laboratory where HF is used, must undertake the SEES HF awareness training and successfully complete the competency assessment.

4 HF First Aid and Emergency Procedures
Hydrofluoric acid is corrosive and can cause severe burns to skin and eyes. Contact with skin may not cause pain immediately and appearance of symptoms can be delayed for up to 24 hours. Hydrofluoric acid is also
an irritant to the respiratory system and very toxic if swallowed. Further information on HF can be obtained from the MSDS available on ChemAlert https://chemalert.rmt.com.au/uow/

All research groups using Hydrofluoric Acid must therefore have:

- Personnel trained in the correct first aid treatment for HF;
- A HF first aid kit easily accessible within the laboratory;
- Calcium gluconate gel available and a program to regular check that it is within the ‘Use by’ date; The gel must be discarded and replaced after the expiry date;
- Safety showers and eye wash facilities in the laboratory where HF is used. These should be checked regularly, with checks recorded on sheet placarded behind the safety shower.

An emergency response card (Appendix A) can be placarded in laboratory or storage area.

A typical HF first aid kit must contain at least:

- 3 pairs of disposable gloves (e.g. Nitrile)
- Container of 500-1000 mg (available calcium) Caltrate tablets
- Calcium Gluconate Gel (has a limited shelf life ~ 1 yr)
- At least 300mL Saline solution (sodium chloride) e.g. Steri Tube, Eyesaline® solution or equivalent
- Eye pads
- Bandages

First Aiders should avoid contact with contaminated skin, clothing and equipment. They should also avoid inhalation of vapours or aerosols in the contaminated area. First aid instructions are supplied in Appendix B and should be placed in the HF first aid kit. First Aiders must protect themselves by wearing:

- Nitrile gloves under chemical resist gauntlets;
- Eye-protection (face-shield preferably);
- Lab coat, or hazard suit, for protection.

An advice sheet (Appendix C) for first aiders to give to medical staff dealing with HF exposure is located in the HF first aid kit. All incidents involving HF must be reported on SafetyNet.

## 5 HF Spills

HF spills must be cleaned up immediately as spilt material may release vapour. Immediately Alert others in the laboratory to the location of the spill. Ensure the correct PPE is worn when cleaning up the spill. For minor spills:

- Make sure the spillage is contained. If possible, do not allow HF to enter drains or confined areas. Contain spills with absorbent boom or sand.
- Dilute spill but use water only when it can be applied at rate much higher than the HF leakage rate – ideally dilute by factor of 10.
Neutralise HF with sodium bicarbonate or lime or HF absorbent – HF Chemizorb.
Wipe up with Hazardous substance wipes
Place all material in sealed plastic bag and label “Hazard - Neutralise HF"
Dispose via UOW Hazardous Waste pickup
Report the incident using SafetyNet

Contaminated clothing should be washed with bicarbonate of soda solution. Contaminated equipment or surfaces can be neutralised with calcium hydroxide or slaked lime, before being washed with water.

A HF spills kit will contain:

- 3 pairs of nitrile Nitrile gloves
- Safety Glasses
- HF Chemiszorb or similar alkali neutralising material (sodium bicarbonate or lime)
- Plastic bags
- Hazardous Substance wipes
- Sand

For large spills outside of the fume-hood the laboratory should be evacuated and Security, Laboratory Manager and/or the School Manager contacted. HAZMAT may be required. Special acid gas respirators are required to treat large spills, outside a fume cupboard.

6 Purchasing HF

The following considerations should be made when purchasing HF:

- Buy and use minimum quantities of HF, just prior to required use. Containers holding HF can degrade and should not be stored for long periods of time;
- The maximum container to be purchased should not exceed 500 mL, to minimise decanting risks;
- A hazardous substance risk assessment must be completed and attached to the purchasing requisition form, else the order will not be processed. This risk assessment needs to be sign by both the Head of School and Dean of Science. For guidance, completed HF risk assessments can be found on SafetyNet and the MSDS is available on ChemAlert. Repeat purchases can use the same risk assessment if the HF is to be use for the same purpose;
- It should be clearly stated on the purchasing requisition form that HF is to be delivered directly to the laboratory and not to the Faculty distribution office. When placing an order it may be necessary to contact the Faculty purchasing office or suppliers to organise this direct delivery.
- On arrival the container of HF should be clearly labelled with the arrival date.
- There should be limited access to secure HF storage.
7 **Using and handling HF**

All activities involving HF must have a documented safe work procedure completed in SafetyNet, prior to use. Always consider eliminating the use of HF. Alternative methods and procedures which do not require the use of HF, but which may give the same results should be investigated.

No personnel are permitted to work alone with HF or out of hours (after 6.30pm, before 8.00am or on weekends), when normal emergency assistance services, for example, first aid, building wardens are not available.

All work should be conducted in a HF scrubber fume cupboard. The fume-hood should have a program of maintenance be in place.

There should be limited personnel access to HF, with a minimum number of people required to handle this substance. Never add water to the acid. In dilution, HF should be added to plenty of water, preferably under the surface of the water in order to minimise the generation of HF vapour and splashes.

In addition to standard laboratory PPE (labcoat, safety glasses, enclosed shoes, long pants and sleeves), the following PPE is also recommended when handling HF:

- a face shield for handling and transferring;
- safety goggles with fume-hood sash down for pipette dispensing;
- a PVC apron;
- natural, butyl rubber or PVC gloves, and sleeve protectors or gauntlet style gloves.

PPE must be worn correctly and checked that it is in good repair. No areas of skin should be exposed. All gloves materials eventually degrade in the presence of HF. They should be regularly inspected and replaced before they break.

Alert other workers in the laboratory that you are using HF in the fume-hood 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.

8 **Labelling**

All containers holding HF solutions and waste residue must be compliantly labelled. This label should include at a minimum the chemical name, concentration and appropriate risk or safety phrases. Labels can be printed from ChemAlert.

9 **Transport and storage of HF**

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.
HF should be stored in 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.). Storage area should be clearly labelled.

HF should be stored in a secure area that is in a restricted, locked laboratory in a ventilated storage cupboard. Ensure the storage location of HF is explicit in ChemAlert laboratory stock holdings. HF is not compatible with glass or metals. Glass containers should not be used for storage. Polyethylene is a suitable storage container for HF and the container should be regularly inspected for degradation.

10 HF Waste

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. Small amounts of HF can be diluted and neutralised.

If there is residual HF in the experiment waste then there should be a dedicated HF residue container. This waste container should be clearly labelled with a University Hazardous waste label (available from the School Office) and the Waste tracking log should clearly state the presence of HF. Residues can be disposed through the normal hazardous waste pickup. The hazardous substance timetable can be viewed at: http://staff.uow.edu.au/ohs/workingsafely/hazardouswaste/index.html

The residue container should be segregated according to compatibility. Redundant stock of HF should be disposed of.
## Version Control Table

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<td>Custodian title &amp; e-mail address:</td>
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# Appendix A : Emergency response to HF

## Emergency response to HF

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<th>LAB SUPERVISOR:</th>
<th>CONTACT INFO:</th>
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<td>IMPORTANT NO'S:</td>
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### SPILL RESPONSE EQUIPMENT

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<td>Small hand shovel</td>
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<tr>
<td></td>
<td>□</td>
<td>Neutralisers: Lime</td>
<td>□</td>
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</table>

### PERSONAL PROTECTIVE EQUIPMENT

| Chemical Lab Coat                          | □ | Enclosed Footwear                                | □ |
| Nitrile Gloves                             | □ | Half Face Respirator                             | □ |
| Safety Glasses /goggles                    | □ | Other:                                            | |

## EMERGENCY PROCEDURE

### MINOR SPILL

1. Immediately notify others in area of the spills
2. Make sure the spillage is contained. If possible, do not allow HF to enter drains or confined areas. Contain spills with absorbent boom or sand.
3. Dilute spill
4. Neutralise HF with sodium bicarbonate or lime or HF absorbent – HF Chemizorb.
5. Wipe up with Hazardous substance wipes
6. Check walkways, floors, stairs, equipment etc for other hazards or damage
7. Place all material in sealed plastic bag and label "Hazard- Neutralise HF"

### MAJOR SPILL

1. Do not touch any substance
2. Evacuate the room and close the door to prevent spread. Secure to prevent others entering other than emergency personnel.
3. Determine if any person is injured. Take care not to be injured yourself. If required contact a first aid officer.
4. Call Admin (ext 4483) to alert the building wardens.
5. Contact:
   - Fire Brigade - 0 000
   - Security - 4900
6. Let emergency personnel know HF is involved and check MSDS.

In conjunction with expert assistance decontamination and clean up procedures will commence.

### SMALL FIRE

1. Use C02 extinguisher, dry chemicals or dry sand.
2. If safe to do so, move undamaged containers from area.

### HF does not burn but may produce poisonous and/or corrosive fumes upon heating.

### HF will react with water sometimes violently, releasing flammable, poisonous and/or corrosive gases and runoff.

### DECONTAMINATION & DISPOSAL

- Dispose of clean-up materials in appropriate bags or plastic buckets. Label with hazardous waste label available from School Office and dispose of on next hazardous waste collection day. See OH&S website for collection dates.
- Contaminated equipment and clothing must also be neutralized & decontaminated.

### SMALL FIRE

- HF does not burn but may produce poisonous and/or corrosive fumes upon heating.
- HF will react with water sometimes violently, releasing flammable, poisonous and/or corrosive gases and runoff.

### REPORTING

Report the spill ASAP to:

- Security & Building Wardens (If Major Spill)

Report Injuries and incidents ASAP to:

- Laboratory and School Manager & OHS unit (ext: 3931) and SafetyNET http://staff.uow.edu.au/ohs/
Appendix B: HF First Aid

Avoid contact with contaminated skin, clothing and equipment!
Avoid inhalation of vapours or aerosols in the contaminated area!

Protect yourself by wearing:
- Nitrile gloves under chemical resist gauntlets;
- Eye-protection (face-shield preferably);
- Lab coat, or hazard suit, for protection.

1. Skin exposure:
- Move casualty immediately to an emergency shower or water source
- Flood with water for 5 to 10 minutes
- Remove all contaminated clothing whilst flushing with running water
- Apply CALCIUM GLUCONATE GEL on and around affected area (note the time applied)
- Gently massage into skin until at least 15 minutes after pain is relieved
- Cover the area with a gel soaked dressing and lightly bandage
- Take casualty immediately to hospital with CALCIUM GLUCONATE GEL, repeat application as necessary during transit.

2. Eye Exposure:
- Immediately flush eye with copious cool running water for at least 20 minutes and continue during transit to hospital
- Dial 000 for emergency services and Security (4900), inform the call handler the accident involves HYDROFLUORIC ACID

3. Inhalation:
- If there is no danger to you, remove casualty away from contamination to clean air.
- Dial 000 for emergency services and Security (4900), inform the call handler the accident involves hydrofluoric acid
- If necessary, place a disposable mask over the casualty (in the first aid kit) and resuscitate the casualty

In all cases
- Call a HF first aider, emergency services (0 000) and Security (4900), as soon as possible to arrange transport to hospital.
- Detailed instructions (Appendix C) on treatment for hospital personnel are in the sheet protector attached to the first aid kit. Take these with you to the hospital.
Appendix C: Advice to Medical Staff for dealing with HF Burns and Exposure

Hydrogen fluoride in aqueous solution is usually referred to as hydrofluoric acid

The damage caused by exposure to this product is far more extensive than that caused by hydrochloric acid and other acids. First aid and medical treatment appropriate to hydrochloric acid is not beneficial with hydrofluoric acid burns. Hydrofluoric acid penetrates rapidly and deeply below fat layers binding and depleting tissue calcium. Failure to commence the correct medical treatment promptly may be fatal.

There is a major risk of systemic toxicity following inhalation, ingestion or skin burns. Calcium depletion (hyperkalaemia) and electrolyte disorders may be fatal. A skin burn involving more than 1% of body area with 50% or more concentration of hydrofluoric acid or more than 5% of body area with any lesser concentrations may be associated with systemic effects. Treatment with intravenous calcium gluconate should commence immediately.

Intensive care unit facilities are likely to be needed. Serum calcium and magnesium determinations should be performed frequently and correction of electrolyte balance may be necessary. ECGs should be monitored routinely for prolonged Q-T interval or bradycardia. Hepatic and renal function should be monitored. IV corticosteroids may be necessary.

Inhalation may lead to chemical pneumonitis, haemorrhagic pulmonary oedema or laryngeal oedema and may be fatal. Be prepared to intubate or perform a tracheotomy. The use of nebulised calcium gluconate in a 2.5% solution should be considered.

Skin burns may become necrotic and gangrenous and damaged area may spread. Infiltration of calcium gluconate into the surrounding tissue may be required for severe burns; this can be performed by the injection of 5% calcium gluconate solution. Injection should be performed with care on the hands, feet and face.

For fingers and toes and less severe burns, continue the application of 2.5% calcium gluconate gel four to six times daily for up to three to four days. Wear gloves while applying gel. If calcium gluconate solution is injected into the fingers or toes great care should be exercised and no more than 0.5ml should be used. Pain not relieved by use of gel is best managed by intra-arterial infusion of calcium gluconate solution in a unit that is experienced in the technique. Surgical debridement of affected area may be necessary in larger burns to control hypocalcaemia. Delayed pulmonary oedema is likely with burns to the face or neck. Local anaesthesia is contra-indicated, so that the splitting of finger and toe nails should be performed under general anaesthesia.

Following contact of this product with the eyes, ensure first aid treatment has been carried out. Instil 1% calcium gluconate solution every two to three hours for as long as considered necessary. Topical anaesthetic and corticosteroid drops may be useful. An ophthalmologist should always be consulted, as severe corneal damage is possible. Long term monitoring may be necessary.

Further information about the treatment of hydrofluoric acid burns can be obtained from the National Poisons Information Centre on 13 1126.

Reference

Modified extract from Plastics and Chemicals Industries Association, Hydrofluoric acid, Code of Practice, June 2006