



SAFETY ALERT: Working with Fluoride ion compound

Purpose

AUSA Safety Alerts are designed to promote the exchange of up-to-date information on health, safety, and environment topics relevant to our members, working in universities and allied industries.

Background/Context

Hydrofluoric Acid (HF) is a well-known toxic corrosive which has caused numerous injuries and deaths in the last 50 years. This alert highlights some of the controls to put in place when working with HF but also other chemicals that can poison users in the same way. Fluoride ions can separate from the compound and combine with water (even humidity in the air) to become HF. Some examples: Ammonium fluoride NH_4F , Potassium hexafluoronickelate(IV) K_2NiF_6 , Fluorine gas F_2 , Sodium fluoride NaF etc.

A fatal incident in Western Australia in 1996 highlights the hazards of working with HF in an unsafe manner. A 37-year-old male laboratory technician was performing acid digestion of oil well core and ditch samples, with 70% w/w concentrated hydrofluoric acid in a fume cupboard. He was believed to be seated when he knocked over a small quantity (100-230ml) of hydrofluoric acid onto his lap, splashing both thighs. Despite both legs being amputated, he died from multiple organ failure 15 days later.

Failure points highlighted from investigation of this incident include: working alone and isolated; working with a significant volume of high concentration reagents in an open container; sitting at the workspace; no high flow rate wash down facility; insufficient personal protective equipment (PPE), in this case, only arm bands and gloves; and no leg protection; and no antidote system available.

Could your substance produce HF?

A complete, beginning to end of task, risk assessment should be your first action. Many Australian states list HF as a scheduled 7 poison requiring additional levels of security and in some cases records of use. Contact the [OHS Regulator in your State/Territory](#) for specific advice.

Consider your process and incident response. Be ready to treat a chemical exposure or react to a spill before you start.

- HF reacts with glass. As such, glass should never be used to store or transfer HF. Use chemically compatible containers, such as those made from polyethylene or Teflon.
- Assess all plant and equipment involved. Plan each movement of equipment and reagent, work with as little and as low a concentration of reagent as possible.
- Close all containers once pouring is completed.
- Check capacity of waste container is sufficient for your full process.
- Ensure all operators are appropriately trained and prepared for any reasonably expected incident such as a spill or splash.
- Consider using a spill tray to contain spills during the process.

A thorough risk assessment should include all points raised in this Safety Bulletin. Ensure you educate your users and confirm they have the skills required to perform the task ahead.

Have a formalised Emergency Response Plan. As the incident previously discussed shows, preparation for a spill or chemical exposure is essential.

- Ensure a safety shower or other high flow (>80L/min) wash system is available.
- Have an **emergency response pack** prepared and in the workspace that contains: relevant SDS; antidote such as calcium gluconate, in date; and multiple nitrile gloves to apply the gel. Note: double nitrile gloves stop secondary chemical contact from occurring.
- Practice your incident response ahead of time.
- Ensure you have the correct PPE. Skin should be fully covered on legs and feet and protect your eyes and face by wearing goggles and a face shield.
- Wear a laboratory coat with a chemical splash apron of rubber, neoprene or Viton, and Tyvek sleeve covers, or a Tyvek suit.
- Wear 6 mil nitrile inner gloves **and** 22 mil (nominal) gauge neoprene or butyl rubber gloves or SilverShield outer gloves. Nitrile gloves (6 mil) may also be used as a layer on top of SilverShield gloves for dexterity.

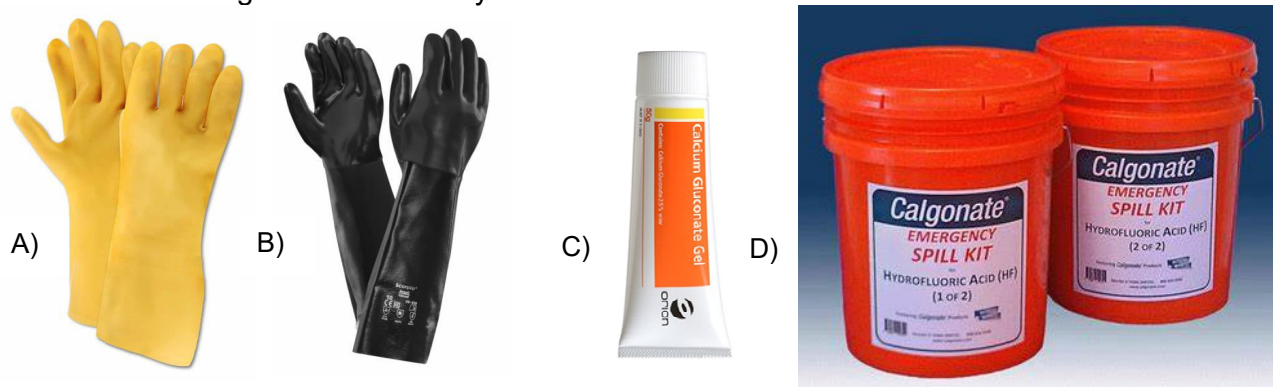


Fig 2: A) MAPA Trionic E194 20 Mil Triple Polymer Blend Gloves or B) Ansell Scorpio 09-928 Neoprene anatomical gauntlets C) Orion Calcium Gluconate Gel 50g D) A HF specific spill kit from www.calgonate.com, other non-silicate containing kits are also suitable.

- At the start of each day check the fume cupboard, PPE and other equipment is fully operational and clean. Know when your antidotes & SDSs expire and have new ones ready.
- Spill kits should have thick LDPE bags/HDPE bins for waste, boots, long aprons with sleeves, multiple gloves, and face shields.
- Full face respirators with A1B1E1K1 chemical filters are recommended for large spills outside of a fume cabinet.
- Do not use sand or other silicate based absorbing materials (e.g., vermiculite) as they react producing SiF_4 gas, all mats should be organic in composition.
- In an emergency ensure emergency services are notified asap. Include your local security teams when establishing protocols, ensure they know how to respond if there is a HF incident.

Never work alone. A HF trained buddy in full PPE is a critical part of the process whenever the reagent is in use. They can watch for spills and keep the operator on task and using best practice. If a spill or exposure occurs, a trained responder is immediately ready to safely assist. If an operator is exposed, send them to the nearest emergency department with the **emergency response pack**. The operator will then have the SDS and antidote and can begin treatment immediately. **Do not hesitate where HF exposure is suspected:** use antidote gel if HF exposure is suspected. The hospital will need 30-60 mins to prepare more antidote once it is ordered by the treating doctor.

Additional Information: Did you know AUSA has a Chemical Safety Special Interest Group? If you are an AUSA member and would like to join, please contact the convenor: m.somodevillatorres@uq.edu.au

- WorkSafe WA Safetyline Institute, 2006 [Case study: Hydrofluoric acid](#)
- WorkSafe WA, WorkSafe Bulletin 2009 [Working with hydrofluoric acid](#)
- Harvard University, 2013 [Guidelines for the Safe Use of Hydrofluoric Acid](#)

Thanks to AUSA Chemical Safety Specialist Interest Group & AUSA member Chemical Safety Consultant Babs Fairchild for their contributions to this Safety Alert