Pressurization of Anhydrous Hydrogen Fluoride Cylinder

Lawrence Berkeley National Laboratory Lessons Learned

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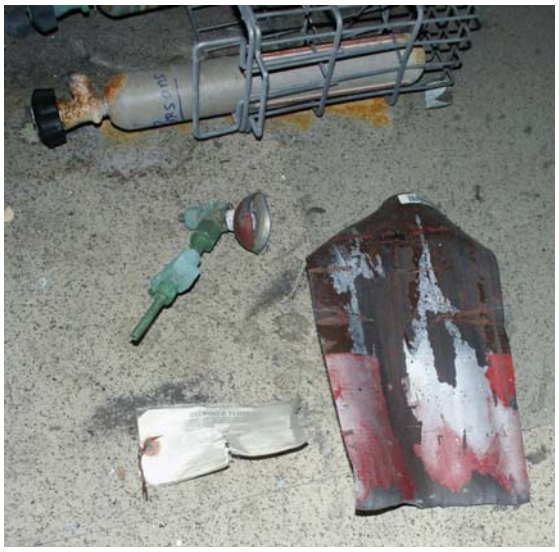
Concern Statement: Aging anhydrous hydrogen fluoride (AHF) cylinders can potentially explode. AHF cylinder over two years old should be returned to the vendor.

Applicable to: All Lab staff that works with anhydrous hydrogen fluoride.

Incident: In July 2005, an anhydrous hydrogen fluoride lecture bottle spontaneously exploded in a UC Santa Barbara laboratory. No one was injured, but the lab was extensively damaged. The photograph (below) shows that the lecture bottle had split along its seam. Its cap and valve assembly are located to the immediate left.



Cause: The explosion was caused by hydrogen gas pressure build up in the cylinder. AHF comes in carbon steel cylinders as a liquefied gas under a pressure of 0.9 psi @ 70°F (i.e., the vapor pressure of the liquid). Though cylinders should be passivated with fluorine, which forms a protective coating, over time AHF may slowly react with the iron in a cylinder to form iron fluoride and hydrogen gas. The generation of hydrogen gas may produce cylinder pressures as high as several hundred psi.

Recommended Actions:

- The recommended safe storage time for AHF is two years. Contact the vendor for pick up and disposal for cylinders older than two years in age. (You should also return unneeded gas, even if it has been less than two years since you obtained it.)

- If the cylinder is less than two years old and you wish to keep it, then:
  - Check the pressure of the cylinder. It must be within the maximum pressure stamped on neck of the bottle. If the pressure is at or above the cylinder's maximum pressure, contact the vendor for pick up and disposal. Do not attempt to move the cylinder yourself.
  - If below the cylinder's maximum pressure, vent excess pressure through an appropriate medium such as Puracarb® available at http://www.purafil.com/ (KOH impregnated activated carbon). Use a two-person team. Conduct venting in a fume hood. Control all ignition sources during venting since most of the vent gas will be H_2. At a minimum, wear chemical goggles, nitrile gloves, and a lab coat for protection against gaseous HF. Keep an HF exposure kit on hand (available free of charge from Health Services, Ext. 6266). An eyewash and safety shower must be readily accessible (within a ten second travel distance). Any skin, eye or respiratory irritation may be indicative of a possible exposure. Follow the first aid procedures listed on the exposure kit. Report all HF exposures to Health Services (Ext. 6266).

Further Information:

- Air Products published a safety bulletin on this AHF cylinder hazards. It can be accessed at the following link: http://www.airproducts.com/Responsibility/EHS/ProductSafety/ProductSafetyInformation/safety_bulletins_PotentialPressurization.htm.
- Contact Larry McLouth at extension 5286 (ldmclouth@lbl.gov) if you have any questions.

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