July 6, 2016

Hello Everyone,

I would like to share with you a selection of the safety incidents/near misses reported for our building from January, 2016 to date.

1. **January 21, 2016: TiCl4 spill and fumes inhalation**
   Description: While a student was transporting a closed bottle of titanium tetrachloride between labs, the small bottle, which was not sealed properly, tipped over in secondary containment and some of the TiCl4 leaked onto the paper towel in the bucket and released fumes, including traces of hydrochloric acid. Although the container was quickly moved to the nearest fume hood, the researcher still inhaled a small amount of the fumes, and felt a mild irritation in the nasal passages afterwards. No medical attention was needed.
   Action: Once the fumes stopped, the spill was cleaned and debris were collected in a plastic bag and disposed of vial REM.
   Recommendations: Be careful when transporting hazardous chemicals between labs. In addition to ensuring the container is placed in a secondary containment, make sure that the primary container is tightly closed. The size of the secondary containment should be proportional to the size of the primary container (e.g. do not use big buckets to transport small bottles, unless they are properly immobilized during transportation.

2. **January 22, 2016: Liquid Nitrogen (LN2) venting affected researcher's hearing**
   Description: The pressure relief valve on a LN2 Praxair 350 psi tank was venting excessively. The pressure relief valve has often iced up and become stuck in the open position failing to close on its own. While standing to the side and wearing the PPE specified in the hazard assessment, following the recommendations in the current SOP, the researcher gave the valve a light tap using a crescent wrench. This caused the valve to forcefully vent just a few inches from the researcher's face. The venting was loud and painful to his left ear in particular. The valve then returned to the closed position. The pressure gauge on the tank was also reading at 400 psi prompting further concern of an over pressurization situation. Several attempts to contact the tank vendor Praxair were unsuccessful.
   As the weekend progressed and hearing was still difficult, the researcher went for an initial hearing evaluation and regular recheck.
   Action: The tank valve was determined to be defective and the tank was mostly emptied in a fume hood using the manual valve. Although the tank was not tagged as defective, the lab staff was notified of the situation. As the used de-icing procedure was not correct, the SOP was modified to include the use a heat blower for de-icing a pressure relief valve.
   Recommendations: The LN2 tanks should be positioned so that the pressure relief valves are facing unoccupied room areas. Hearing protection should be worn when servicing tanks that are not empty as disturbing them can cause sudden and unexpected venting near the employee. De-icing with a cloth soaked in warm water or heat blower like a hair dryer should be used instead of tapping the frozen valve with an object, as tampering with a frozen metal part can lead to very dangerous situations.

3. **January 29, 2016: Rupture of autoclave due to overpressure**
   Description: A researcher loaded a zeolite synthesis gel mixture in two Teflon lined autoclaves of 125 mL each and placed them in the constant temperature convection oven set at 160° C. Next day, the researcher discovered that the two vessels failed due to overpressure built in the vessels. The autoclaves were found in the same position but with a hole in the lid, and the contents were spilled on

the inside of the oven. The lab was unoccupied at the time of the incident. Several causes of this incident were identified: (1) – the autoclaves were slightly overfilled, leading to over pressurizing the container during this procedure. (2) The Teflon liners on the lid were already deformed and weakened from previous experiments, thus not totally safe to use. (3) Manufacturer recommendations were ambiguous regarding the filling level of the autoclavable containers, not making a difference between the filling levels for different capacity vessels.
Action: The damaged Teflon liners were decommissioned immediately and the inside of the oven was cleaned. The SOP for this process was modified to fill the 125 mL autoclaves to max. 50% level and to use only undamaged lids.
Recommendations: Always use full PPE (lab coat, safety glasses, safety gloves – both nitrile and thermal – and face shield when opening the oven after this type of procedure, to avoid an injury in case of a reaction vessel rupture at the time of opening the oven door.

4. February 6, 2016: Amine spill in glovebox antechamber

Description: When opening the antechamber of a glovebox, a researcher was exposed to a fine mist of chemical from a small spill of ethylene diamine that was left uncleaned by a previous user of the glovebox. No medical attention was needed.
Action: The researcher immediately closed the antechamber, left the lab, and returned equipped with a respirator and proper PPE, and cleaned up the spill.
Recommendations: As not all glovebox antechambers are equipped with ventilation, only use the antechamber of a glovebox for working with volatile chemicals after making sure this has the necessary ventilation. If a spill occurs, make sure you clean it up appropriately before leaving the work area.

5. March 20, 2016: Powder spilled in drying oven

Description: A sample of a solid chemical, containing excessive residual toluene after filtration was put in a plastic boat to dry at 45° C on the lowermost shelf of a drying oven. Unknowingly, the plastic boat reacted with the toluene and some of the sample leaked out. As the researcher tried to clean the spill, some of the sample dropped onto the heating elements of the oven and started to release fumes.
Action: The oven was immediately shut off and was not restarted until the heating elements were cleaned.
Recommendations: (1) Make sure enough time is allowed for proper filtration of your sample; this will ensure the amount of solvent in the sample that needs to be fried is minimal. (2) Make sure the sample placed in the oven does not react with the tray used for drying. Inert containers, such as glass Petri dishes should be used for this type of activity, rather than plastic trays.

6. April 4, 2016: Burn from ampule during sealing process

Description: A researcher was sealing an ampule using a butane torch and noticed that the glass was hardening and became un-malleable. He took the ampule out of the flame and tried to set it down in the hood, when accidently ran his thumb across the neck, and burned his thumb. His hand reflexed back, and he dropped the ampule. The ampule broke at the joint where it was headed, but both ends remained sealed. The researcher was wearing two sets of gloves, general use nitrile gloves, as well has heat resistant Kevlar gloves and his hand was not in the flame at any point in the incident.
Action: The researcher turned off the butane torch, then put his thumb under cold tap water, after which he cleaned up the spill in the hood. A small blister (~1/4 in diameter) formed on my thumb where it came in contact with the hot glass
Recommendations: A holder should be installed so that an ampule could be safely secured in place out of the flame if necessary, and without having to take your hand off of the body of the ampule.

7. **April 21, 2016: Damaged wheel on rolling liquid nitrogen tank**
   Description: While bringing a full liquid nitrogen tank back to FRNY from the Physics loading dock, a portion of the tank's wheel fell off, after the tank went over a small bump (about ¼ section of the wheel). The tank was still functional, but much noisier and slightly more difficult to push.
   Action: The damaged wheel was replaced
   Recommendations: Always check the mechanical integrity of the carts used to transport gas cylinders and LN2 tanks and plan your route in advance to avoid running into bumps and holes that can damage the cart and lead to safety incidents.

8. **May 16, 2016: Leaking cryogenic fluids on power cables**
   Description: When entering the lab, a researcher found that the LN2 tank was leaking at a low rate causing significant condensation on the liquid feed line and was freezing over a power cable for the a glovebox (see photo below). The researcher put on cryogenic gloves, closed the valve, and carefully moved the line into the cardboard Dewar holder box. The cable did not appear to be damaged, but exposure to cryogenic liquids could have caused cracking of the cable's insulation.

   Likely cause: line was not tightly closed after previous use. During glove box purging, the tank cools and the metal contracts which may have allowed a small amount of liquid to pass through the valve.

   Recommendations: Always place the liquid line in an appropriate container (preferably not a cardboard box) after use and ensure that the valve is tightly closed after use.

9. **May 20, 2016: Glovebox regeneration odor in FRNY 3140 and subsequent building evacuation**
   Description: During a routine glovebox catalyst regeneration process, extremely strong odor was experienced and the fire department was called to assist. This led to the evacuation of the building and the access to the research lab was restricted until air quality measurements determined that the lab environment is free form H_2S, CO and Volatile Organic Compounds (VOCs).
   A more detailed report on this incident will be sent in a separate document.

10. **June 14, 2016: Glovebox Regen Odor Found on Skin after Performing Glovebox Maintenance**
    Description: While performing the maintenance on two gloveboxes, old polymer exhaust lines were replaced. These exhaust lines, containing some residual liquid left after the catalyst regeneration process, were placed in a washing hood. In an attempt to contain the strong smell, and to dispose of the old lines, a researcher moved them to a ventilated trash cabinet. While doing so, some liquid came into contact with the researcher's wrist at the section not covered by the lab coat sleeve and safety gloves. The liquid was mostly water, but some traces of amines and thiols may have been in this solution.
    Action: Upon discovery of contact with the clear liquid, the researcher washed his wrist with soap and water. The smell disappeared within a few minutes and there was no skin irritation on the wrist. There was no residual smell on the lab coat sleeve.

Recommendations: When moving tubing containing liquid or any other imperfectly sealed containers with liquid, it may be beneficial to wear large neoprene gloves on top of the regular nitrile gloves, as an additional layer of protection. However, be aware that due to the thickness of the gloves, there will be loss of dexterity. Take additional care in handling fragile objects when wearing this type of gloves.

There were some other smaller incidents/near misses reported like broken glass vessels in the lab, damaged laboratory equipment, etc. None of them led to injuries or the need of medical attention. Please continue to report any safety incidents and near misses that occur in your work area; sharing them with everyone in our School will raise the safety awareness and prevent similar situations from happening.

Some lessons learned and general recommendations:

1. Always ware your personal Protective Equipment when working in the lab
2. Always follow the standard operating procedures and pay close attention to details.
3. Make sure you follow the manufacturer's recommendations when it comes to using different instruments or lab equipment.
4. Check any equipment used to transport chemicals, equipment, gas cylinders, etc. for mechanical integrity, and only use them if they are in good working condition.
5. Report any safety incidents or near misses to the group safety officer and to the Safety Committee Chair, and discuss them in your group meetings. Sharing this type of information is key in increasing safety awareness.

I hope that sharing these incidents with you will help prevent similar events from happening in our School!

Sincerely,

Gabriela
On behalf of the ChE Safety Committee