Case Study: Fire in Wetherill Laboratory (February 2004)

Described below is an accident that occurred in the Chemistry Department prior to our current standards of chemical safety and hazard awareness (i.e. Chemical Hygiene Plan). The lab fire resulted in some damage to the research laboratory, but fortunately no injuries. It is an instructive example of what happened, how it was reported, and lessons learned (Corrective Action and Preventive Awareness, or CAPA).

Strong praise goes to the researchers, principal investigator, and safety officer who took the time and effort to provide a highly detailed description of how the incident was handled. Today, accidents and near-accidents can be reported routinely and in a timely fashion through our online incident reporting system.

Note: By the time of this entry (December 2018), the frequency of fire-related incidents in the Department has dropped to less than one per year. Regardless, the prevention and effective handling of laboratory fires continues to be a top priority.

Main Message: Proper safety training, compliance with standard operating procedures (SOPs), and good housekeeping practices are the three most effective factors in preventing laboratory fires and other potential catastrophies.

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In February 2004, a fire broke out in a research laboratory in the Chemistry Department, resulting in partial damage both inside and outside the fume hood (see photos below). Heat-activated sprinklers and a rapid response by the Purdue Fire Department were effective in suppressing further property damage, and building evacuation plans proceeded smoothly. Nevertheless, this fire could have been prevented by improving standards of safety awareness and compliance.

Student report (notes in brackets added for clarity): "On Thursday, Feb. 5th close to 4:00 P.M. I was performing a recrystallization. The process involved warming some acetone (<5 mL) in an Erlenmeyer flask on a hot plate. After checking as to whether the acetone was warm to touch, I added some petroleum ether to the flask. All of a sudden I heard the Erlenmeyer flask pop and saw some smoke, but I didn't recall seeing any fire until the 4-liter bottle of pet. ether in the corner of my hood [*with cap open*] and my fume hood counter were both in flames.

"There were several other organic preps. in my hood that were sitting in flasks containing chloroform and dichloromethane. At the time I thought there was a great possibility that my hood would explode due to all of the organic solvents, so I moved the 4-L bottle of pet. ether [*still on fire*] to the sink and called for help with a fire extinguisher, however the two extinguishers we used didn't help. The fire become more aggressive, which activated the sprinkler system.

"Also, while trying to put out the fire, one of our undergraduate researchers ran to pull the fire alarm. By this time, the PI was alerted and told everyone to evacuate the lab and leave the building. So we closed the door to the lab and left the building.

"This fire came way too close to getting out of control. We were very lucky."

[*The fire was successfully suppressed by the sprinkler system and prompt arrival of the Fire Dept. The students later submitted photos of the incident*.]

Figure 1. Fume hood where the fire originated (in corner), during a recrystallization with acetone and petroleum ether.

Figure 2. The (flaming) 4-liter solvent bottle was placed in sink outside of fume hood. The fire continued to burn, and could not be put out by handheld extinguishers. The automatic sprinklers were eventually activated.

Figure 3. The fire engine arrived in less than 10 minutes, and the incident was quickly and successfully resolved (Wetherill was fully evacuated by the time the firefighters arrived).

Lessons learned (CAPA)

What went wrong:

a) The fume hood was far too cluttered at the time of the accident. (corrected by good housekeeping)

b) Too many open containers of solvents, and in close proximity to an active hot plate. (corrected by best practices, including student training with a well-written SOP)

c) Removed flaming object from fume hood. (correct action: lower fume hood sash all the way, then pull fire alarm and/or call 911).

d) Inadequate training with fire extinguishers.* (correct action: pull fire alarm and/or call 911).

* Note: Hands-on training and proper usage of fire extinguishers may be helpful and is even encouraged. However, it cannot be considered as part of a standard operating protocol in emergency situations. The correct thing to do first is to call 911 and/or pull the fire alarm, whichever is faster.

What went right:

a) Researcher was not working alone at the time of accident

b) Fire alarm was pulled within first few minutes of accident (the earlier, the better)

c) Excellent compliance with building evacuation procedures

d) Fire Department arrived quickly, and had easy access to the building and laboratory.

e) Researchers faithfully submitted a detailed report on incident, in the spirit of safety education and awareness -- a key step to preventing future accidents!

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