Fume Hood Explosion points out need for better understanding of hazards, lab communication

The fume hood after the explosion. Credit: University of Minnesota

On June 17, an explosion in a chemistry lab at the University of Minnesota injured a graduate student as he was synthesizing trimethylsilyl azide. University officials say the incident originated in lack of hazard awareness and highlighted the need to identify hazardous processes and better communicate these hazards.

The synthesis was based on previously published methods but altered in an attempt to eliminate production problems. At the time of the explosion, the injured student was not wearing personal protective equipment. The explosion left him with second-degree burns and glass injuries to his arm and side and an eardrum. The explosion also destroyed the experimental apparatus and hood.

Investigators have not been able to definitively identify what went wrong with the reaction. One explanation is that the explosion from hydrazoic acid, which was produced as an unrecognized product of the modified process.

The investigation also noted another root cause of the incident was insufficient recognition of the reaction's hazards. As the protocol was modified, the researchers didn't appear to understand how changes might affect the risk of the synthesis. Although literature protocols included warnings about hazards, they were not explicit enough. The investigators also felt the lab group became complacent after performing the reaction several times without incident.

The injured student noted that "I think that the biggest lesson that I have taken away from the experience is that though a synthetic procedure is well-documented in the literature, the inherent safety concerns may not be. A corollary of this is that researchers need to be sure that they are properly heeding the warnings that they do have, and properly recognizing the risk of everything that could go wrong in a particular synthesis, even if those risks seem unlikely."

The Department has ordered lab groups to assess their standard operating procedures and update them if necessary. The goal is to get everyone to stop and think about whether they're doing anything that is potentially hazardous, whether they have an SOP for that activity, and whether

the SOP is correct, he says. Meanwhile, the department's safety committee and its Joint Safety Team with chemical engineering and material science are working out how to review the procedures as well.

Additionally, lab groups will now be required to use "safe operation cards" on lab hoods to communicate who's running a reaction, what it is, and its hazards. Safe operation cards are something that the department learned about through interactions with Dow Chemical to promote lab safety.

As a result of this incident the investigators have recommendations for the chemistry community at large:

1. Update risk assessment procedures to identify factors affecting the probability and severity of an energetic event occurring and to consider the capabilities of available safety controls.
2. Researchers should not assume journals include complete risk control information.
3. Encourage researchers to perform complete risk assessments on all potentially hazardous experiments.
4. Develop additional tools and training to help researchers assess the severity of consequences, probability of occurrence and capacity of controls.

Adapted from "More details on the University of Minnesota explosion and response" by Jyllian Kemsley on Jul 30, 2014 on the Chemical & Engineering News