

Lessons Learned

Dry Scraping Causes Chemical Explosion

What Happened?

A postdoctoral researcher was synthesizing a potentially explosive material in a fume hood, following a well-established procedure published in a peer-reviewed journal. The researcher was transferring a residual amount of the synthesized material using a plastic spatula when the material exploded in his hands. The shattered glassware caused some minor cuts to the researcher's hands.

Other group members helped the injured researcher wash the injuries and called campus police. He was taken to the hospital where he got treatment for the injuries, and he was released from the hospital a couple of hours later.



Photo 1 - laboratory bench after the explosion

What went right?

- The researcher was working behind the sash in a properly functioning chemical fume hood, as called for in the relevant SOP.¹
- The researcher was wearing a flame-resistant (FR) coat, gloves, and safety glasses, as called for in the relevant SOP.¹
- The researcher had worked with the same conditions and scale multiple times in the past, and was familiar with the synthesis.
- Relevant training was completed, including *EHS 101: Laboratory Safety Fundamentals Refresher* and the group's hands-on training for work with Potentially Explosive Compounds (PEC).

- A synthesis-specific safety debrief was completed before starting the work as required by the group's internal policy.
- After the explosion, other group members in the room dropped to the floor and used the closest exit to crawl out of the laboratory.
- Emergency protocol was followed once the incident took place (irrigation of the affected areas, removal of contaminated PPE and clothing, contacting emergency personnel).
- The group used the emergency signs posted in the laboratory to locate the correct emergency response contact information.
- After the explosion, group members recognized the potential hazards created by the explosion and did not reenter the laboratory until instructed to do so by the fire department.

What should have been done differently?

The journal article that was referenced highlighted specific hazards of the reaction and recommended that the material be kept wet with solvent at all times, and by noting that the dry material explodes when scraped or heated. The researcher transferred the majority of the material into a beaker with solvent. By the time he tried to transfer the residue left on the filter, however, the material was already dry and exploded upon contact with the plastic spatula. The explosion was caused by friction between the plastic spatula and the funnel. To prevent an incident like this, it is important to ensure that the material is thoroughly wet with the appropriate solvent.

What corrective actions have been taken?

- As a new precaution, researchers in this lab are required to wear a combination of cut resistant Kevlar® gloves covered with a pair of chemical-resistant disposable gloves when working with these materials.
- In order to further mitigate risk, the group will only use plastic, tape or mesh-coated glassware or plasticware for work involving PECs.
- The PEC SOP will be modified to reflect these changes.
- Relevant researchers will review and sign the modified PEC SOP.

¹ Standard Operating Procedure for Potentially Explosive Compounds

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Incidents involving PECs have the potential for disastrous consequences. Fortunately, the safety practices the lab group had in place were followed, and a serious injury was avoided. Workplace hazards cannot be completely eliminated, but by implementing and following good safety practices, the consequences of an accident can be mitigated significantly. Finally, the SOP includes details that are important to follow closely. In this case, keeping the material wet is important to prevent an explosion.

[Campus Guidelines for Potentially Explosive Chemical Safe Storage and Handling](#)

For additional assistance, contact EH&S at ehs@berkeley.edu or (510) 642-3073, Lessons Learned date: Nov 2015