

Incompatible Waste Incident

November 2023

What Happened:

On 11/29/2023, at approximately 8:30 am, an Engineering graduate student researcher, working in a fume hood poured a solution of nitric acid, ethanol, isopropyl alcohol, and hexane into a 1-gallon liquid waste container already containing aqua regia (a solution comprised of a 3:1 mixture of hydrochloric acid and nitric acid, respectively). After capping the container, it was placed in a corrosive storage cabinet beneath the fume hood. A few minutes later, a pressurized release was heard, and a brown plume of smoke emerged from the corrosive cabinet. Liquid solution was also observed on the floor outside the cabinet. The researcher promptly left the laboratory and notified the PI.

EHS was notified approximately three hours later. Upon arrival at the scene, EHS observed sorbent pads placed over the liquid that spilled on the floor, as well as inside the storage cabinet. The graduate student indicated he had not been trained on how to handle the etchant solutions properly and how to dispose of the acid waste. He also stated that he knew that the waste solution he generated was incompatible with the aqua regia solution but still proceeded to pour the waste solution mixture into the aqua regia waste container.

EHS closed the lab area and determined that it was best to have an outside contractor clean-up the spill the following day to allow the waste solutions to cool down. EHS reassessed the spill the following day for residual corrosive liquids and evaluated the extent of contamination. Based on the presence of corrosive liquids in the area and the requirement for respiratory protection, an approved third-party vendor was contracted to perform the clean-up, which included the decontamination of floors, corrosive cabinet, chemical container, and fume hood. The hazardous waste was packaged for disposal, and the lab was reopened for research.

Primary factors that contributed to the incident:

1. Incompatibility of the acid waste mixture.
2. Aqua Regia waste container did not have the required vented cap. The solution oxidizes over time and the container will become over pressurized if the cap is completely closed and becomes energetic when mixed with incompatible chemicals. Adding solvents, organic compounds, or water to the mixture will quickly develop heat from the mixing process and become potentially explosive.
3. Graduate student involved in the incident did not receive required/adequate safety training.
4. Standard operating procedures (SOP) were not developed or shared with staff performing the work.

Root Cause of the Incident: Lack of training and no written standard operating procedures (SOPs) were created for this process.

Steps that can be taken to prevent this type of incident:

- Train researchers on appropriate waste storage and disposal procedures for the hazardous materials they handle. Aqua regia, for instance, requires a vented cap and should be stored within a fume hood. This, along with a detailed use procedure, needs to be written into a Standard Operating Procedure.
- Train all researchers on the chemical compatibilities and incompatibilities of the substances they handle. Combining nitric acid, ethanol, isopropyl alcohol, and hexane with aqua regia for disposal must be avoided.
- Train researchers on the appropriate protocol for spills/accidents, including contacting EHS immediately.
- Develop written procedures for all operations involving hazardous materials.
- Periodically hold group safety meetings to discuss safety, near misses, concerns, etc., and emphasize the importance of safe work practices.

Where to Get Help or More Information:

For more information or assistance, please contact EHS at (949) 824-6200 or at safety@uci.edu.