SAFETY BULLETIN

King Abdullah University of Science and Technology

جامعة الملك عبدالله للعلوم والتقنية

Waste Bottle Explosion with Potential to Cause Serious Injuries

Purpose of the safety bulletin: To inform the research community about an incident that happened recently at KAUST laboratory and to communicate the importance of knowing the hazards of chemicals you work with and to dispose them properly.

What happened?

On the 12th October 2020 at approximately 14:40 pm, a chemical waste bottle located at the satellite accumulation area in the service corridor exploded, causing other bottles in the same secondary container to break and spill their contents into the service corridor. The blast and impact from the broken glass caused damage to the service corridor door, walls, ceiling tiles, and light bulbs. No injuries were reported from this incident.

Explosion of hazardous waste bottle causing chemical contaminated debris and spill in the service corridor.

Why did it happen?

- The explosion occurred due to a reaction of 100 ml of aqua regia mixed with ethanol residue.
- The researcher did not prepare the aqua regia but inherited aqua regia along with other chemicals.
- The aqua regia solution was prepared in the lab but there was no SOP for conducting this work.
- The aqua regia had been stored in a plastic container for more than 1 year and shown signs of pressurization with container bulging and cap not fitting.
- The container was decided to be disposed but it was rejected during waste collection as it was deemed hazardous.
- The researcher was not aware of aqua regia hazards and the disposal requirements.
- Following waste rejection, the researcher attempted to dispose aqua regia as hazardous waste pouring the content into a reused ethanol glass bottle which had not been rinsed and dried.

Working with aqua regia

Aqua regia is a corrosive, fuming yellow liquid prepared by slow mixing of one part of concentrated nitric acid with three parts of concentrated hydrochloric acid (1:3 molar mixture). It is used to dissolve metals such as gold, platinum, silver, etc. Aqua regia solutions are extremely corrosive and oxidizing; handling solutions improperly may result in explosion or skin burns. Do NOT use aqua regia unless it is necessary.

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Aqua Regia and nitric acid solutions safety requirements

- Always use glass (preferably Pyrex) containers. Aqua regia will melt some plastics and corrode or dissolve most metals.
- Never store aqua regia solutions. Mix up only what you need, then treat as hazardous waste after each use.
- Aqua regia quickly loses its effectiveness. Mix a fresh solution for each use.
- Never store or leave aqua regia in a closed container without a pressure venting cap. It will oxidize over time to form toxic gases and can lead to an explosion.
- **Mixing aqua regia or any other nitric acid solutions with organic compounds may cause an explosion. Never, ever put any solution that might have even a small amount of aqua regia into an organic waste container, or put an organic solvent or liquid into a container that has aqua regia in it (even a small residue).**

Condition of secondary container after explosion.

Damage to window in the service corridor door.

Expectations from KAUST research community on lessons learnt:

- Laboratories to establish systematic process and procedures (SOP) for experiments and/or preparing solutions involving hazardous materials.
- Laboratories to establish strict hazardous waste management procedures including steps to ensure all reused bottles are emptied and dried. Waste containers available at the chemical warehouse.
- All staff must be trained in accordance to the SOPs.
- Aqua regia solution must be used immediately and treated as hazardous waste after each use. It is prohibited to store aqua regia solution.
- Quench aqua regia before disposal and dispose other nitric acid solutions into clean waste containers.
- To quench aqua regia, dilute the solution and carefully neutralize by adding small portions of sodium or potassium carbonate with stirring. When the solution no longer foams upon addition of carbonate, it can be disposed

Please submit any questions to researchsafety@kaust.edu.sa

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