

Lab Safety Alert

Aqua Regia Waste Disposal



INCIDENT DATE: March 19, 2021

SUBJECT: Aqua Regia Waste Bottle Explosion

BACKGROUND:

A 4L glass bottle labeled 'dilute aqua regia' was sealed and stored for disposal in a cabinet underneath a fume hood that is used to consolidate aqueous waste streams for users. Standard practice in the lab is to neutralize aqua regia waste with an excess of sodium bicarbonate. The pH of neutralized aqua regia is typically tested after gas evolution ceased to ensure it is not strongly acidic and then the solution is disposed via UVic's hazardous waste stream. At 23:10 on March 19th 2021 the 'dilute aqua regia' waste bottle exploded.

INJURIES

Although two people were present in the lab area at the time of the explosion, no one was injured as they were not in close proximity to the cupboard. There was a strong acrid smell in the lab and had to immediately evacuate.

EQUIPMENT DAMAGE

The explosion of the bottle ripped the door off the hinges of the cupboard where the bottle was stored. Approximately 3L of the acidic solution that spilled on the floor contacted and corroded two gas cylinders that were adjacent to the cupboard.





IMMEDIATE CAUSE

The bottle exploded because it over pressurized in a sealed container. It is believed that the bottle was mislabeled as 'dilute aqua regia' when it was actually a solution of aqua regia neutralized by excess sodium bicarbonate, these two chemicals are incompatible where carbon dioxide gas is the main product. The most likely cause for the bottle to over pressure was that a third party added more aqua regia to the bottle because the bottle was placed in a communal location. Hence, gas build up of carbon dioxide was most likely produced from the reaction of the added aqua regia and excess sodium bicarbonate.

LEARNING OUTCOMES

The explosion could have been prevented if (1) the aqua regia waste bottle was labeled correctly as, for example, "aqua regia neutralized with excess sodium bicarbonate" and (2) a vented safety cap (such as Circumvent Caps) was used instead of the original bottle cap. A Circumvent cap should always be used with solutions known to be reactive and over pressurize regardless if it is for waste or not. Circumvent caps can be obtained free of charge at Science Stores.

RECOMMENDATIONS TO PREVENT RECURRENCE

- Use container vented safety caps (Circumvent Caps) for waste that have the potential to build pressure (regardless if neutralized)
- Accurately label waste bottles
- Ensure lab is adequately supplied with emergency supplies
- Prepare a safe operating procedure (SOP) for the safe use and handling of aqua regia with emergency protocols

More information about hazardous waste disposal:

<http://ohs.uvic.ca/environment/waste.php>

More information on the use of venting safety caps (Circumvent Caps)

<https://www.uvic.ca/ohse/assets/docs/caps.pdf>

UVic's SOP on safe use and handling of aqua regia:

https://www.uvic.ca/ohse/assets/docs/laboratory/swp003_aqua-regia.pdf