SAFETY BULLETIN

King Abdullah University of Science and Technology

جامعة الملك عبدالله للعلوم والتقنية

Lessons Learnt from University of Hawaii incident March 2016

Purpose of the safety bulletin: To inform the research community about an incident that happened in University of Hawaii and to highlight the importance of risk assessments and safety requirements.

What happened?

On Wednesday 16th March postdoctoral researcher Thea Ekins-Coward was working on combining hydrogen, carbon dioxide, and oxygen gases from high-pressure cylinders into a lower pressure container. The mixture was to be used as a feedstock to grow bacteria to produce bioplastics and biofuels inside of a low-pressure tank. The investigation report from Honolulu Fire Department investigation EHRS 2016 Safety Alert (KB) UPDATED 8/4/2016 concluded that an electronic gauge, which was used to measure the pressure inside the gas-mixing vessel, created a spark when Dr. Ekins-Coward pressed the “off” button. The spark ignited the gas inside the tank, triggering the explosion. The electronic gauge was not designed to be used in a system containing a flammable gases mixture. A mixture of 70% hydrogen, 25% oxygen, and 5% carbon dioxide was used in the experiment. The week before the incident, a similar set-up with a 3.8-L tank resulted in a “small internal explosion” when Ekins-Coward pressed the off button on the gauge. She also occasionally experienced static shocks when touching the tank, which was not grounded. She reported the shocks and possibly the small explosion to PI, who told her not to worry about it.

Independent investigation report findings:

- **Lab Safety Inspections:** Lack of rigorous safety inspections.
- **Chemical hygiene & hazardous waste plan:** No evidence of updates.
- **Lab Specific SOPs & Training Program:** Lack of lab specific SOPs and training over and above general safety requirements.
- **PPE:** Researchers were not wearing appropriate PPE. Furthermore, despite using a highly flammable gas and pure oxygen, wearing flame resistant laboratory coats was not the norm.
- **Gas Cylinder Use:**
    - Improper gas cylinder restraint and storage, unlabeled gas lines and leaking aged regulators.
    - The gas storage tank contained an O2 enriched mixture and was not properly cleaned as combustible oil was found on the threaded fittings.
    - Use of plastic tubing such as polyethylene (PE) is not safe for hydrogen gas as it can diffuse through the wall.

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Expectations for the KAUST research community based on the lessons learnt:

- Never underestimate the hazards associated with an experiment.
- Gas cylinders should be restrained by chains and secured.
- Clear and detailed standard operating procedures and lab specific training should be provided to all lab users.
- Regular discussions about Near Miss and Lessons Learned events should be conducted to remind lab users of the risk involved when working with highly hazardous substances or processes.
- Mixing a flammable gas (hydrogen, methane, etc.) with an oxidizer gas (oxygen, chlorine) is an inherently unsafe activity. In the worst-case scenario it can result in a reaction leading to a detonation which can be fatal and cause significant damage.

Ideally, regulatory compliance is not the end goal of a safety program, but rather the outcome of a strong culture of safety in the workplace.

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

Based on the Report to the University of Hawaii at Manoa on the Hydrogen/Oxygen Explosion of March 16, 2016

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