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CHEMICAL & ENGINEERING NEWS

Latest News
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Spark from pressure gauge caused University of Hawaii explosion, fire department says

Postdoc Thea Ekins-Coward, who lost an arm in the incident, was using a gauge r specified for work with flammable gases

By ***Jyllian Kemsley***

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Debris littered a lab bench after the explosion.

Credit: Honolulu Fire Departmen

An explosion last month that caused a University of Hawaii, Manoa, postdoctoral researcher t **lose an arm <http://cen.acs.org/articles/94/i13/Researcher-Thea-Ekins-Coward-loses.html>** was caused by a spark from a digital pressure gauge that was not designed for u with flammable gases, says a **Honolulu Fire Department investigation report <https://www.documentcloud.org/documents/2805224-2016-05-30-Honolulu-Fire-Department-Report-on.html>** .

Thea Ekins-Coward was combining hydrogen, carbon dioxide, and oxygen gases from high-pressure cylinders into a lower pressure tank when the incident occurred. She has not given t university permission to release information about her condition, said spokesman Daniel Meisenzahl at an April 18 press conference.

The gas mixture was "food" for bacteria being used to produce biofuels and bioplastics. Ekins Coward was working for the Hawaii Natural Energy Institute under researcher Jian Yu. A 2013 paper by Yu indicates a set-up in which gases are plumbed through a mixing device called a g proportioner directly into the bioreactor (*Int. J. Hydrogen Energy* 2013, DOI: **10.1016/j.ijhydene.2013.04.153 <http://dx.doi.org/10.1016/j.ijhydene.2013.04.153>** The gas gauge identified in the paper is an "intrinsically safe" model designed to prevent ignit

But after Ekins-Coward started in the lab last fall, she purchased a 49-L steel gas tank, a diffe gauge not rated as intrinsically safe, a pressure-relief valve, and fittings, and she put them together, Yu and Ekins-Coward told fire department investigators, according to the report. Eki Coward would add the gases to the portable tank, which would then be connected to the bioreactor. She was using a mixture of 70% hydrogen, 25% oxygen, and 5% carbon dioxide fo her experiments, the report says.

In 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, the fire department repor says. She also occasionally experienced static shocks when touching the tank, which was not grounded. She reported the shocks and possibly the small explosion to Yu, who told her not tc

worry about it, the report says.

On the day of the incident, the 49-L tank exploded when Ekins-Coward pressed the off button the gauge. "She did not lose consciousness or hit her head; she was aware that she lost her a in the explosion," the report says. "She couldn't open the door to the lab, the door was stuck closed." Security officers and a graduate student kicked in the door to help Ekins-Coward get Her right arm was severed just above the elbow, the report says.

The University of Hawaii hired the University of California **Center for Laboratory Safety <https://cls.ucla.edu/>** to independently investigate the incident. That report is expected t completed by the **end of this month <http://cenblog.org/the-safety-zone/2016/04/uc-center-for-laboratory-safety-is-investigating-u-hawaii-explosion/>** . The Hawaii Occupational Safety & Health Division is also investigating the incident.

Disaster Scene

These photos, released by the Honolulu Fire Department, illustrate the force of the March 16 explosion and its consequences. (warning: some images are graphic)

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The steel tank that ruptured in the March 16 explosion.
Credit: Jian Yu/U Hawaii

The explosion caused damage in the hallway outside of the lab.
Credit: Honolulu Fire Departmer

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The hallway outside the lab door after the explosion.

Credit: Honolulu Fire Department

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Compressed gases in the lab included hydrogen, carbon dioxide, helium, and carbon monoxide.

Credit: Honolulu Fire Departmen

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This steel tank ruptured during the explosion, which severed a researcher's arm.

Credit: Honolulu Fire Department

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Chemical bottles fell and glass broke in the northeast corner of the lab, next to the bioreactor for growing bacteria.
Credit: Honolulu Fire Departmen

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The explosion knocked down ceiling panels, broke light fixtures, and scattered debris throughout the lab.
Credit: Honolulu Fire Department

The remains of the steel tank sit at the site of the explosion, near the south wall of the lab.
Credit: Honolulu Fire Department

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The explosion also shattered fume hood sash windows and knocked over equipment in the northwest corner of the lab.
Credit: Honolulu Fire Departmen

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An oxygen cylinder was nearly knocked over in the southwest corner of the lab, something that could have added to the damage.

Credit: Honolulu Fire Department

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Possible circuit board from the pressure gauge that caused the explosion.

Credit: Honolulu Fire Departmen

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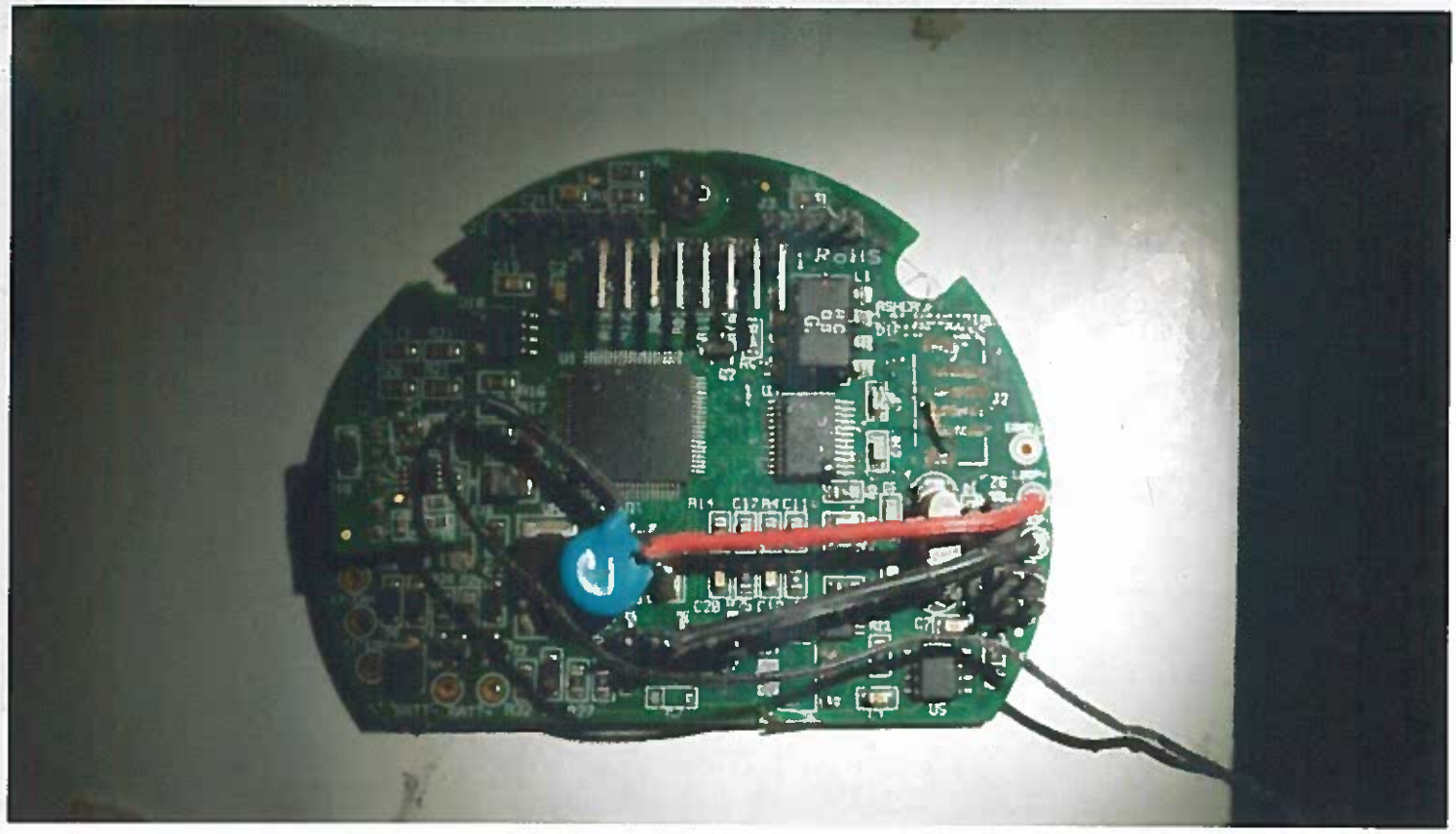

Photo of a circuit board on top of debris.

Credit: Honolulu Fire Department

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Postdoctoral researcher Thea Ekins-Coward lost an arm in the explosion.

Credit: Honolulu Fire Departmen

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Comments

Tom C. (April 19, 2016 4:19 PM)
Looks like lessons were not learned from the previous small explosions in the lab. Mixing hydrogen and oxygen without proper controls and hazard assessment can always lead to a big explosion. This incident could have been easily stopped using proper controls. Big loss for the researcher! We need to look the safety culture of the lab involve in this incident plus departmental culture as a whole. Was a SOP developed by the PI of the lab for this experiment, w would like to see the same. Otherwise it only remains a forum discussion, similar to the rainbow experiment.
» **Reply**

Robert H. Foster (April 20, 2016 1:53 PM)
Agreed with Tom C. While I was not there and do not have the benefit of the full investigation, I have combined oxygen and hydrogen and had an explosion (all I lost was the hair on both hands). The risk of explosion from a number of ignition sources is very high, and a thorough review of SOPs for all work presenting those ignition risks should be undertaken. A question is also raised about the safety equipment (such as shields or remote