Lesson Learned Briefing

No.: LL19-0032

Title: Over-Pressurization of a Vacuum System Results in Injury

Event: LBNL Event

Event Date: 09/10/2019

Category: ESH-Pressure Safety - Pressure Systems (any)

Lesson Learned Statement:
Pressure systems (both positive pressure and vacuum systems) present significant stored energy hazards that can quickly lead to injury or property damage. These hazards must be properly evaluated and controlled for every pressure system. We must continually conduct Integrated Safety Management (ISM) to assess where things could go wrong and implement controls to prevent or mitigate the consequences of an accident.

Discussion:
On September 10, 2019 an incident occurred which resulted in an injury to a LBNL graduate student working in a UC Berkeley campus laboratory space.
The graduate student was transitioning a vacuum chamber from vacuum (~10^-6 torr) to atmospheric pressure by backfilling with inert gas. This process was usually performed by first shutting off the turbo pump and closing the valve to the roughing pump. After the turbo stopped spinning, dry nitrogen from a pressurized gas cylinder would be added. The standard practice was to monitor the pressure gauge of the vacuum chamber until it reached atmospheric pressure, at which time the nitrogen gas would be shut off and the flanges opened. The student started this process and began to do other lab work. During this time, the chamber over-pressurized and the glass viewing window ruptured. The rupture was severe enough to cause injury to the student and damage to equipment due to flying debris (see photos).

Preliminary Analysis:
Apparent Cause
- The vacuum system did not have installed pressure relief protection which would be required if equipment damage or potential injury was possible due to over-pressurization of the system.

Contributing factors:
- A written Standard Operating Procedure (SOP) for the work was

lacking as well as a formal hazard analysis of the work.
- It appears that the user had no institutional training in the areas of gas safety or pressure safety.
- The gas regulator used was not the optimal regulator for the operation performed.

There are several preliminary lessons that can be learned from this incident:
1. Intended or unintended pressure/stored energy must always be properly evaluated and mitigated to prevent equipment damage or injury. Contact your safety coordinator or subject matter expert for help if you are unsure about any pressure or vacuum system in your laboratory.
2. Processes or procedures which have been performed many times without incident are not necessarily safe, especially if they have not been evaluated for hazards and when process deviations occur. It is important to have fail-safes in the system, such as, but not limited to, pressure relief devices. Take a moment to review common procedures and processes in your laboratory and ask yourself what could go wrong, and how you might prevent it.
3. Hazard analysis and application of ISM, along with work authorization and adequate safety training, can help prevent accidents. Ensure that training is complete and hazards have been identified and controlled via work authorization before starting work. If you're not familiar with a system, request on-the-job training from your Activity Lead.
4. It is important to choose the right equipment for the task (a low pressure regulator, in this case) to minimize the potential consequences of an accident.

Actions to Prevent Recurrence:
The investigation into this incident is still in the early stages and LBNL will be following up to determine if any corrective actions are needed. If any additional lessons learned or actions are identified, LBNL will issue a follow-up Lessons Learned briefing.

Lessons Learned are part of the ISM Core Function 5, Feedback and Improvement. Applicable Lessons Learned are to be considered during working planning activities and incorporated in work processes, prior to performing work.

Please contact the following subject matter experts if you have any questions regarding this briefing.

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Uploaded documents/attachments:

Damage to Equipment from Flying Debris.jpg
Ruptured Viewing Window.jpg

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