



# Student Laboratory Safety

## Lawrence Berkeley National Laboratory Lessons Learned

LL-2002-5

**Concern Statement:** Continuous supervision and complete training (including OJT-On the Job Training) of students performing experiments at the laboratory is key to preventing serious accidents.

**Applicable to:** All Divisions especially those employing students and guests in a research capacity.

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### Incident

An undergraduate student added 1gram magnesium and 3 grams water to a spherical glass reaction vessel (approximately 10cm in diameter and 1 liter volume). The open ends of the vessel were sealed with plastic stopcocks and the vessel was wrapped in heater tape and cover in aluminum foil. The heater tape was plugged directly into a 120V AC wall outlet and left to heat on a laboratory bench top. The student left the room. A bang was heard 15 minutes later. The vessel had exploded. There were no injuries and no significant property damage occurred.

### Cause

The experiment and the potential pressure build up in the vessel had been previously discussed by the student and the supervisor. Initial discussions pertained to using 1 gram of water and heating the vessel, which was rated to withstand 4atmospheres of pressure, to 150<sup>0</sup>C. The plastic stopcocks used to seal the vessel were rated to withstand temperatures of 200<sup>0</sup>C. The student and supervisor also discussed the use of heater tape to achieve a uniform heating and the use of a thermocouple probe to monitor temperature inside the vessel. The supervisor told the student that he would show him how to use a thermocouple probe.

The student then proceeded without supervision to carry out the experiment. He had no experience in the use of heater tape or thermocouple probes. By plugging the heater tape (max. output power rating 800 Watts) directly into an AC outlet (instead of a variable current transformer-Variac), the vessel and its contents heated rapidly causing vaporization of the water and a pressure build up which exceeded the limits of the vessel resulting in its failure and subsequent rupture. Based on the volumes used it is estimated that the vessel was heated to 300<sup>0</sup>C and reached an internal pressure of 7.5 atmospheres. At lower temperatures and using smaller volumes of water (as previously discussed), the pressure in the vessel would not have exceeded its' estimated rating of 4 atmospheres.

The student did not wear any personal protective equipment while performing this experiment nor did he place a protective barrier in front of the heating vessel. He had been working at the laboratory as a research assistant for approximately one year, had completed a JHQ and taken most but not all of the required training. Chemical Hygiene and Safety training, though required, had not been taken.

### Recommended Actions

- ❑ The supervising personnel need to review the JHQ of all their employees to ensure that their training corresponds to the potential hazards they may encounter during the course of their duties especially when responsibilities or activities change.
- ❑ Experimental set-ups (especially by students) should be inspected by supervisors prior to the work commencing to ensure that all safety and health issues have been identified .
- ❑ The supervisor must ensure and document that On The Job Training (OJT) has taken place. This should include an observation of step-by-step procedures to ensure that all issues are addressed.

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### Further Information

Any additional assistance or questions regarding this incident or the lessons learned may be directed to the Paul Vetter (6518) or Kathie Hardy (5533).

For other lessons learned, go to: [http://www.lbl.gov/ehs/html/lessons\\_learned.htm](http://www.lbl.gov/ehs/html/lessons_learned.htm)