1st TAKE

Safety ACTION

Incident ALERT Message from Performance Surety

FOR DETAILS:

- **Occurrence Report:** ALO-LA-LANL-CHEMLASER-2004-0001
- **PS-7 Occurrence Investigators:** Matt Hardy, 667-6335; Rita Henins, 665-6981

An additional alert about this event will follow if the investigation reveals details that indicate an unknown hazard exists for other employees involved in this type of activity. For more information about "1st Take," please call LANL PS-7 at 665-0033.

August 18, 2004
LANL CHEMLASER 2004-0010

Student sustains laser eye injury

On July 14, 2004, an undergraduate student employed by another government agency was injured while performing work with a Class IV neodymium (Nd):YAG laser at Los Alamos National Laboratory. The student came to the Laboratory to work with a LANL scientist investigating the potential use of lasers in studying the composition of comets.

The scientist and student had set up a laser experiment designed to suspend and then analyze particles inside a vacuum target chamber using an unusual configuration that was neither described nor analyzed in work control documents. The experiment used a Particle Generating (PG) laser to suspend the particles and the (Nd:YAG) Laser Induced Breakdown Spectroscopy (LIBS) laser to vaporize the suspended particles. The PG laser was aligned vertically to allow the beam to enter through the top of the target chamber; the LIBS laser was aligned horizontally to allow the beam to enter through a side window. The scientist energized both laser power supplies and was operating the LIBS laser with the Q switch trigger cable disconnected (a mode the scientist believed did not allow the LIBS laser to produce a laser beam). With the Q switch disabled and the LIBS laser's flashlamps operating, the scientist believed that only white light exited the laser's optical tube and traveled down the laser beam path. The scientist wanted to demonstrate that the PG laser could suspend particles from the sample and intended to use the light from the LIBS laser to illuminate the suspended particles and make them visible inside the target chamber.

The scientist fired and secured the PG laser and then observed the suspended particles illuminated by the LIBS laser inside the target chamber. He told the student he could see suspended particles and invited the student to take a look. As the student bent down to look into the chamber, she saw a flash and subsequently noted a reddish brown substance floating in her left eye. Neither the scientist nor the student were wearing laser eye protection. The student was taken to LANL's occupational health facility (HSR-2) and was referred to several eye specialists. Laser eye damage was confirmed. The student continues to experience loss of central vision in her left eye.

Laser operations were suspended and the LANL Director assembled a team to investigate the accident, determine the causal factors, and make recommendations.

Experimental setup showing the target chamber and the LIBS laser

Re-creation of target viewing position

Initial Analysis

The investigation is nearing completion and formal findings will be made available in a few weeks after corrective actions are developed and incorporated. Lines of inquiry have included the use of personal protective equipment, the mentoring and supervision of students, management oversight and control of work/workers, and the reporting and notification process for abnormal events. Laboratory measurements were made to characterize the conditions and configuration believed to have existed when the accident occurred. Measurements indicated that the student could not have received a laser eye injury under these conditions because the LIBS laser did not emit a beam in this configuration. Consequently, the team is evaluating if other configurations could have resulted in the accident.

Initial Recommendations

Management Level: Managers should:

- Ensure that required safety practices are implemented in the workplace;
- Ensure training requirements are completed before authorizing work;
- Ensure that personal protective equipment is used;
- Ensure laser personnel complete a baseline eye examination;
- Ensure changes to work and associated changes in work configuration are authorized, and that these changes are addressed in work control documents; and
- Provide LANL employees with this "1st Take," either through Nested Safety meetings or required reading programs.

Worker Level: Workers should:

- Know the hazards of their experiment;
- Wear specified laser eye protection as required;
- Challenge unsafe or questionable behavior, and if you're not sure, ***ask***;
- Use interlocks as designed; and
- Prevent eye exposure to direct or scattered radiation from a Class IV laser.

More information will be provided to employees in the "Final Take" alert message from Performance Surety.

GUIDANCE: Resources at hand

For more information related to laser safety you can refer to:

- Lasers LIR 402-400-01.3
- Laser Safety: Class 3b or 4 Self Study Course No. 17817
- American National Standards Institute Z136.1 (Safe Use of Lasers)
- Lessons Learned: Operational Experience Summaries, 2nd Quarter - 2004 (http://www.eh.doe.gov/paa)
- Occurrence Report: ALO-LA-LANL-CHEMLASER-2004-001
- Occurrence Report: OAK-LBL-MSD-2003-0001
- Occurrence Report: ALO-LA-LANL-FIRNGHELAB-1999-0002
- Occurrence Report: ALO-LA-LANL-FIRNGHELAB-1998-0002