

Date: Thu, 04 Mar 1999 10:22:36 -0600  
From: Meredith Brown <racer@lanl.gov>  
Subject: Yellow Alert: Laser Eye Burn

**TITLE: Failure to Wear Eye Protection Results in Laser Eye Burn**

IDENTIFIER: 1999-LA-LANL-ESH7-0005 DATE: March 4, 1999

**LESSONS LEARNED STATEMENT:** Light having a wavelength of 800 nm, as produced by a short pulse length laser, is slightly outside the normal visible spectrum (400 to 700 nm) but can be seen by some individuals at a deceptively low visual intensity. For laser users this phenomenon presents two significant hazards: (1) not perceiving that the laser is on for those who cannot see 800 nm wavelength light, and (2) assuming that the laser power is much lower than it really is for those who can see 800 nm wavelength light. Also, extremely short pulse length lasers are deceptive because the potential for eye damage is much greater than for continuous wave lasers of the same average power. For short pulse length lasers operating at full power, it is therefore prudent to wear protective eyewear even when the beam is in a controlled optical path unless the beam is completely contained in beam tubes or optical fibers.

**DISCUSSION:** A postdoctoral employee received an eye exposure to diffusely scattered light from an 800 nm wavelength Class IV laser beam. The extremely short pulse (100 fs) beam caused a 100-micron-diameter burn to the employee's retina at relatively low average irradiance (2 microwatt/cm<sup>2</sup>). The accident occurred shortly after a mirror was removed from its mount and replaced with a corner cube during a realignment procedure. Although the beam had been blocked during several previous steps in the alignment, it was not completely blocked in this case. The employee was exposed to diffusely scattered light from the corner cube mount when he leaned down to check the height of the mount. Neither of the two employees performing the alignment was wearing the appropriate laser eye protection.

**RECOMMENDATIONS:** Consider asking a laser subject matter expert to conduct a walkaround to ensure that safe laser practices are being followed in your facility. When working with short pulse radiation (<1 ps, 0.5 mJ @ 800nm), assess the existing hazard controls to ensure that they are adequate, and take precautions to ensure your safety and that of your coworkers by following basic laser safety guidelines.

- 1) Re-assess the hazards and mitigations when a laser apparatus undergoes any significant change.
- 2) Never assume a coworker has turned off the laser, placed beam blocks in the path, or otherwise has made the system safe for you - check for yourself.
- 3) Supplement operating procedures with redundant measures. For example, have coworkers assess the situation or remind each other of hazards and precautions (i.e. to wear personal protective equipment).

4) Always wear appropriate eye protection during alignment operations, and if in doubt, wear eye protection even if not explicitly required.

5) Review the operating procedures or work permit authorizing the work before beginning, then follow the prescribed procedures.

ORIGINATOR: Los Alamos National Laboratory

CONTACT: Phil Romero, 505 665 8503 or 505 665 7384 (fax)

AUTHORIZED DERIVATIVE CLASSIFIER: Meredith Brown, 505 667 0604

REVIEWING OFFICIAL: Connon Odom

DOE FUNCTIONAL CATEGORY: Safety

KEYWORDS: laser, exposure, visible, eyewear

REFERENCES: Occurrence Report ALO-LA-LANL-FIRNGHELAB-1999-0001

**FOLLOW-UP ACTIONS:** Information in this report is accurate to the best of our knowledge. As a means of measuring the effectiveness of this report, please contact the originator of significant action(s) taken as a result of this report or of any technical inaccuracies you find. Your feedback is appreciated.