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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-KO-SNL-0001 Date: 04/09/99

Lessons Learned Statement: Personnel who do not wear available eye protection during beam alignment can sustain eye injuries. All accidents of this nature are avoidable if laser safety requirements are followed. At Sandia, laser safety training and the development and implementation of Technical Work Documents (Safe Operating Procedures) are mandatory before personnel work with Class 3B and Class 4 lasers. The use of appropriate eye protection is also mandatory when working with Class 3B and Class 4 lasers.

Discussion: Three recent laser safety occurrences have been reported in the DOE complex since December 1998. In all three occurrences, personnel who were not wearing available eye protection during beam alignment, sustained eye injuries. Unfortunately, this type of accident is all too common.

Analysis: An analysis of laser accident data involving 272 accidents reported to Rockwell Laser Industries from 1964 to 1994 reveals that eye injury was the most commonly reported laser related accident and was involved in slightly over 74% of all of the accidents recorded. Over 90% of the eye injury cases recorded some function loss of which 77% was permanent. The most common cause of accidents was accidental eye exposure during beam alignment, the second most common cause of laser accidents resulted from misaligned optics, and the third most common cause of accidents was failure to wear available eye protection.

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Sometimes personnel tend to discount the importance of safety precautions. The following dramatic account by a victim of such an accident was prepared in the hope that his experience may increase vigilance among his colleagues.

"The necessity for safety precautions with high power lasers was forcibly brought home to me . . . when I was partially blinded by a reflection from a relatively weak Nd:YAG laser beam. Retinal damage resulted from a 6 millijoule, 10 nanosecond pulse of 1064 nm radiation. I was not wearing protective goggles at the time, although they were available in the laboratory. . . . When the beam struck my eye I heard a distinct popping sound, caused by a laser induced explosion at the back of my eyeball. My vision was obscured almost immediately by streams of blood floating in the vitreous humor, and by what appeared to be particulate matter suspended in the vitreous humor. It was like viewing the world through a round fish bowl full of glycerol into which a quart of blood and a handful of black pepper have been partially mixed. There was local pain within a few minutes of the accident, but it did not become

excruciating. The most immediate response after such an accident is horror. As a Vietnam War Veteran, I have seen terrible scenes of human carnage, but none affected me more than viewing the world through my blood filled eyeball. In the aftermath of the accident I went into shock, . . ."

Good vision is priceless. The Bureau of Labor Statistics (BLS) estimates that 90% of all workplace eye injuries are preventable with the use of proper safety eyewear. The BLS also reports that eye injuries in the workplace cost over \$467 million annually. Adding the indirect costs such as legal fees, judgements, and training replacement workers, places the estimated total above \$934 million annually. No dollar figure can adequately reflect the personal toll these accidents take on the injured personnel.

Recommendations: Follow established laser safety requirements. Always wear appropriate laser safety eyewear during operations with Class 3B and Class 4 lasers.

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