Summary of the ANL Laser Eye Injury of Sept. 17, 2004

What Happened

An Accelerator Systems Division researcher was assembling a Laboratory Directed Research & Development funded experiment in a laser lab of the Experimental Facilities Division. The experiment project is based on a composite laser system comprised of three main lasers: a Class 3B Ti:Sapphire oscillator (800 nm), a Class 4 Nd:YLF drive laser (527 nm) and a Class 4 Ti:Sapphire amplifier. The amplifier's 800 nm output is an invisible beam that is used in the experimental optics. For normal operations, the primary hazard control is a fully enclosed beam path; for alignment, laser protective eyewear is the primary hazard control. During the alignment at about 1745 Friday 17 Sept, the researcher turned partly away from the optical table and raised his laser protection glasses to rub his left eye. Part of an un-noticed beam from a beam splitter-attenuator entered his left eye and caused a retinal burn-through lesion and resultant floaters. The researcher shut down the laser and went home. On Saturday, he left a voicemail telling his supervisor that he had suffered a laser injury.

Root Causes

1. **The hazard of the splitter's ability to direct the Class 4 beam off of the optics table was not identified & analyzed.**

2. **The hazard of a secondary beam created by the beam splitter was not controlled.**

3. **The PI failed to wear laser goggles as prescribed in the SOP, dated 4 Mar 2003.**

Contributing Causes

1. An unshielded beam splitter was put into use on the optics table without guards in place to control a recognized hazard.
2. Verbal agreements between the Laboratory's Laser Safety Officer and the PI following several postponements of the formal review of the laser table layout obfuscated their understanding of the work that could be performed prior to start of Class 4 laser operations.
3. Roles & Responsibilities were not defined and communicated; e.g. the group leader who appointed the replacement Laser Controlled Area Supervisor did not provide clear direction regarding the LCAS role and his responsibility to monitor safe work practices and work place conditions, or explain the extent of the LCAS's authority.
4. The Class 4 laser was not taken out of service and the SOP formally cancelled by XFD management when key personnel changed and the laser was inactive.
5. The LDRD project did not receive an Experiment Safety Review as required by ESH Manual Chapter 21-2.

Issues & Lessons Learned

The first two are issues that create the possibility of making an injury more severe through aggravated hemorrhaging or onset of shock:

1. The PI did not immediately report the laser eye injury.
2. The PI was working alone during alignment using a Class 4 laser.

The latter two are items that complicated and prolonged the investigation:

3. Incident investigation analysts must be involved from the onset of an investigation.
4. Management needs to have timely accident investigation reports so that the necessary changes can be accomplished before the accident is forgotten.