Laser Safety
Lessons Learned
Office of Science
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Laser Safety Lessons Learned

Chicago Office
Safety and Technical Services
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Laser Safety Lessons Learned

Laser Incidents for DOE and Rockwell Laser Industries, Inc. Data Bases

- Alignment 40%
- Malicious (6%)
- Interlocks 4%
- Stray beam 9%
- Self-inflicted 4%
- Procedure violation 16%
- Other (20%)
French Experience

- 55 Accidents over 11 years
  - 39 Exposed to laser beam
    - All during alignment without laser eyewear
    - 27 permanent eye injury
  - Accidents either inexperienced person or highly experienced (5-10 yrs working with lasers)
Laser Safety Lessons Learned

• National Safety Council
  – 37.2 % laser accidents alignment

• Rockwell Laser Industries, Inc
  – 36.7 % laser accidents alignment

• DOE
  – 47 % laser incidents in alignment
    • 64% laser eye injuries from alignment
    • SC 80% laser eye injuries from alignment
<table>
<thead>
<tr>
<th>Facility</th>
<th>Date</th>
<th>Event Summary</th>
<th>Individual Involved</th>
<th>Cause</th>
</tr>
</thead>
<tbody>
<tr>
<td>Argonne National Laboratory</td>
<td>September 21, 2004</td>
<td>While aligning the diagnostics by introducing beam onto a table while aligning the optics for an ultrafast Ti:Sapphire class 4 laser (800 nm), an experimenter raised his laser safety eyewear to rub his eye and an undetected beam struck his left eye.</td>
<td>Scientist</td>
<td>The user was not authorized to extract beam onto a table. A Laser Standard Operating Procedure had been submitted, but was still being reviewed. The laser configuration on the table had not been inspected or approved by the Laser Safety Officer and Division Director.</td>
</tr>
<tr>
<td>Brookhaven National Laboratory</td>
<td>September 9, 2003</td>
<td>The user was attempting to repeat an alignment procedure while viewing the beam with an inspection mirror. The graduate student injured the retina of both eyes.</td>
<td>Graduate Student</td>
<td>The user was not wearing laser eyewear. The user was also uncertain of the alignment procedure but proceeded to conduct the alignment for an operation which he did not have authorization or experience.</td>
</tr>
<tr>
<td>Lawrence-Berkeley Laboratory</td>
<td>March 14, 2003</td>
<td>A user’s eye was struck by a specular reflection of an Nd: YAG laser during alignment.</td>
<td>Graduate Student</td>
<td>The user was not wearing laser eyewear. He was also aware of changes made to optical beam path.</td>
</tr>
<tr>
<td>Argonne National Laboratory</td>
<td>October 26, 2001</td>
<td>A user’s eye was struck by a reflection of a Ti: Sapphire laser during alignment.</td>
<td>Visiting Researcher</td>
<td>The user was not wearing laser eyewear during alignment of the laser system while the system was at full power.</td>
</tr>
<tr>
<td>Brookhaven National Laboratory</td>
<td>September 1, 2000</td>
<td>A Class IIIb laser was being operated without being reviewed or approved.</td>
<td>Scientists</td>
<td>A team of users had set up an Argon ion laser without review or approval for its operation.</td>
</tr>
<tr>
<td>Brookhaven National Laboratory</td>
<td>August 6, 1999</td>
<td>During a DOE Laser Safety Audit a Class IV laser interlock failed when tested.</td>
<td>Scientist</td>
<td>A short in the interlock system was not identified during an interlock test during the previous month.</td>
</tr>
<tr>
<td>Argonne National Laboratory</td>
<td>July 27, 1999</td>
<td>A Class IIIb He-Ne laser was operating unattended within a Laser Controlled Area without proper interlocks.</td>
<td>Scientist</td>
<td>A Class IIIb laser was substituted for a Class II laser without appropriate interlocks being installed.</td>
</tr>
<tr>
<td>Argonne National Laboratory</td>
<td>April 20, 1999</td>
<td>Laser beam reflected during laser welding operation ignited ceiling tiles.</td>
<td>Welders</td>
<td>The hazards of the laser welding operation were not fully analyzed.</td>
</tr>
<tr>
<td>Brookhaven National Laboratory</td>
<td>April 2, 1999</td>
<td>A laser interlock on a hatch door was defeated by the User to allow opening the door to observe the operation of the laser.</td>
<td>Scientist</td>
<td>The user failed to follow the interlock procedure.</td>
</tr>
<tr>
<td>Ames Laboratory</td>
<td>November 5, 1997</td>
<td>A Class IIIb laser was found operating unattended in alignment mode in an unsecured area.</td>
<td>Scientist</td>
<td>The users failed to follow procedures established for this laser operation.</td>
</tr>
</tbody>
</table>

* Incident information obtained from CAIRS and ORPS databases
Laser Safety Lessons Learned

• DOE Experience
  – 34 incidents 1983 – 2004
    • SC 18 (10 eye injuries from laser strike)
    • Other PSOs 16 (13 eye injuries from laser strike)
      – each has dye splashed into eyes
Laser Safety Lessons Learned
Final Message

• Proper Laser Eye Protection is imperative!
• Know the hazards and appreciate the risks!
• Alignment work planning very important.
• We have many examples to study.

• Never assume!