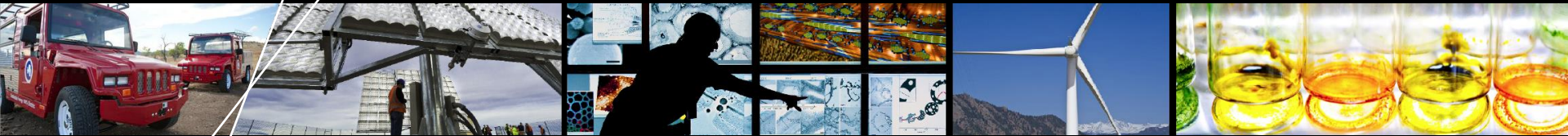


Recent Laser Events at DOE Labs



2013 DOE LSO Workshop

Barbara O’Kane, CIH, CSP, CLSO

September 12, 2013

Brought to you by your LSSG

- EFCOG = Energy Facility Contractors Group
- LSSG = Laser Safety Subgroup

DOE Lab Obligations for Laser Safety

- **Codified in 10CFR851 – Worker Safety & Health Standard**
 - Establishes requirements for worker safety & health programs, includes OSHA 1910, 1926, 1904
 - Additional enforceable requirements
 - ANSI Z136.1, “Safe Use of Lasers,”(2000)
 - NFPA 70E (2004) –Electrical Safety in the Workplace

Reporting requirements

- Required by DOE Order 232.2 – [Occurrence Reporting and Processing of Operations Information](#)
- DOE collects this information for purposes of:
 - Remaining informed of events with potential for adverse impact
 - Promote:
 - organizational learning,
 - enhance mission safety
 - share effective practices
 - To support continuous improvement

Reporting criteria

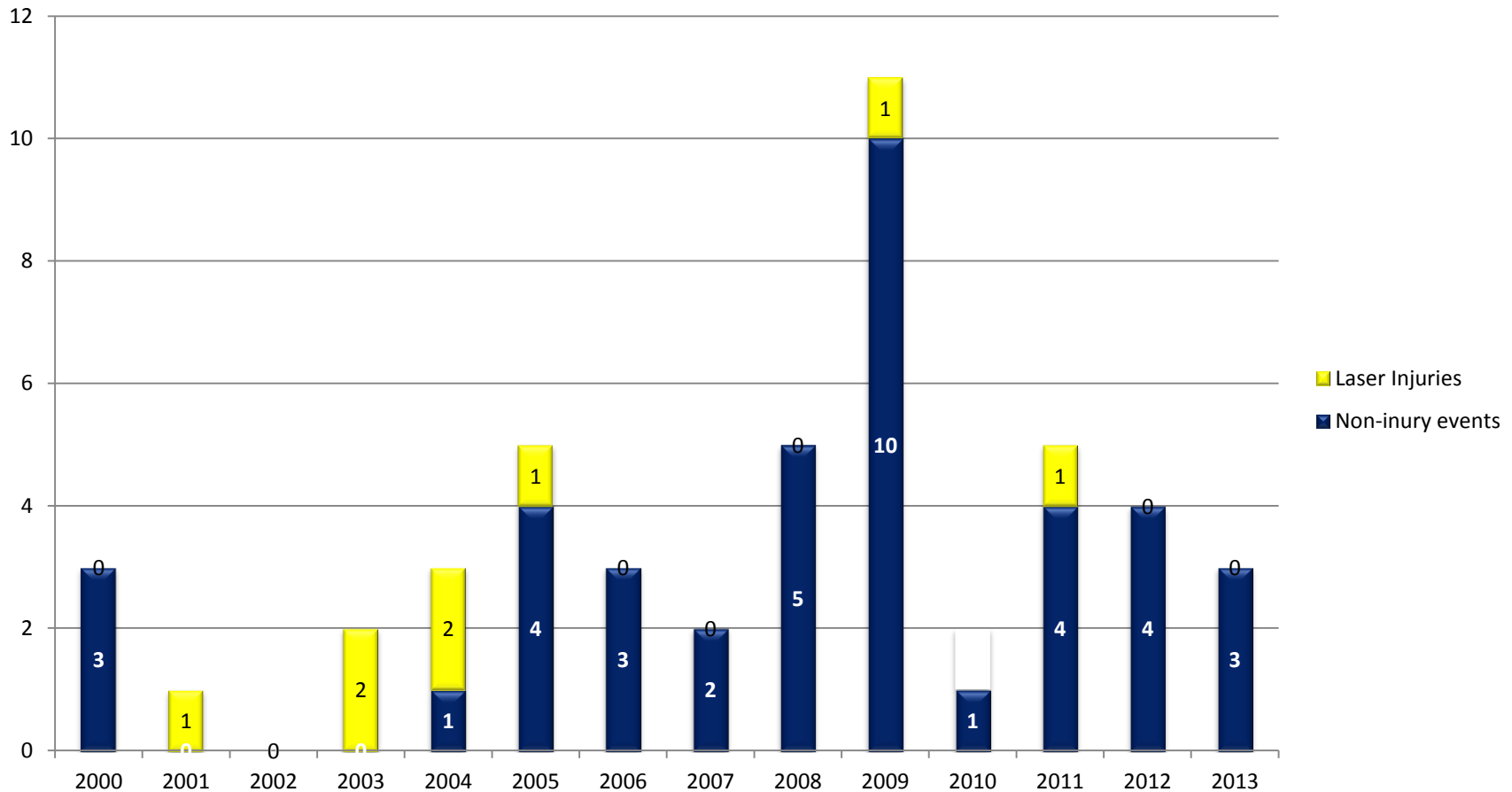
- **Detailed in the order**
- **Typical laser event reporting criteria include:**
 - Exposure resulting in occupational injury (retinal damage)
 - Unexpected or unintended contact with a hazardous energy source (burns)
 - Fires
 - Exposure to electrical (shock, arc flash)
 - Defective material (eyewear)
 - Management concern and near miss (everything else)

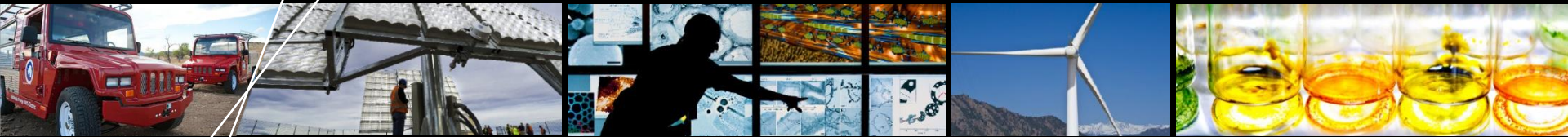
Another reporting mechanism

- Non-compliance tracking system (or NTS)
- Incentives contractor self-identification, reporting and corrective action
- Reporting of noncompliances by contractors is voluntary
- Is there a regulatory noncompliance?
- Does the event or condition meet a reporting threshold?
- If the answer to both questions is YES, the noncompliance is NTS reportable.

Laser Related Events through the Years

Laser Occurrences 2000-2013 YTD





ORPS Events since last year's workshop

Discovery of Potentially Defective Laser Protective Eyewear

- **Oct. 18, 2012 LANL**
- **Worker observed green light (527 nm) through laser safety glasses.**
- **Glasses OD = 7, 532 nm. Not marked for 527, but manufacturer information indicates an OD = 3.1**
- **No injury or property damage**

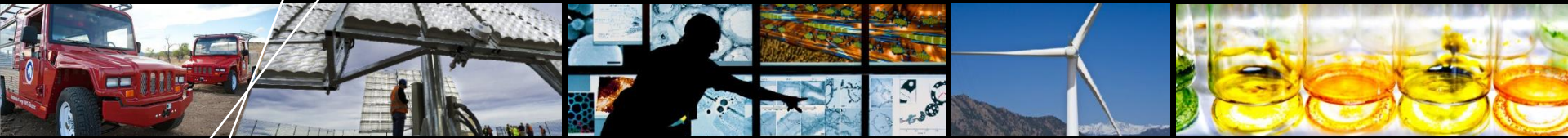
Laser Shutter Failure

- **Feb. 28, 2013 SLAC**
- **When in Class 1 operation mode green light was observed coming from small gaps in the enclosure**
- **Shutter blade securing screws were found to have failed**
- **No hazardous exposure, injuries or property damage**

Laser Gas Sampling System Beam Splitter Installed Incorrectly (non-beam)

- April 4, 2013 Pantex
- LGSS could not be aligned properly because the beam splitter had been installed upside down
- No injuries





Non-Compliance Reports

Unauthorized Use of Laser

- **May 14, 2012 NSTec Livermore Operations**
- **Privately purchased laser in Facility laser lab**
- **Labeled as 3B, output of 2.7 mW (3R)**
- **Regardless, noncompliances include:**
 - Non-registered 3B laser
 - Operator unqualified
 - Laser owner handed out laser to unqualified operator
 - Implementation of procedures

Programmatic Deficiencies Associated with EHS Training

- **Oct. 31, 2012 NREL**
- **NTS mostly about training issues, however laser specific documentation was found to be less than adequate**
 - Laser operator qualification process requires signatures of LSS and Line Manager
 - A couple of forms were found without the Line Manager signature

PPPL Laser Safety Program

- **Feb 14, 2013 Princeton Plasma Physics Lab**
- **Minor deficiencies identified during audit combined to warrant a report**
- **Fix: annual review of laser lab controls, will have to be audited by the LSO;**
- **Status of laser operations will be verified by the supervisors/managers**

Common Cause Analysis of SLAC Laser Events

- **May 21, 2013 SLAC**
- **Looked at four events from 2009 to 2013**
- **Programmatic weakness – “failure for laser operations to ensure adequate integrity for Class 1 laser enclosures and associated laser safety shutters”**
- **Laser supervisor failed to ensure adequate controls**
- **Laser operator failed to follow SOP requirements for Class 1 operation**

How are we doing today compared years ago? Greater reporting, fewer injuries

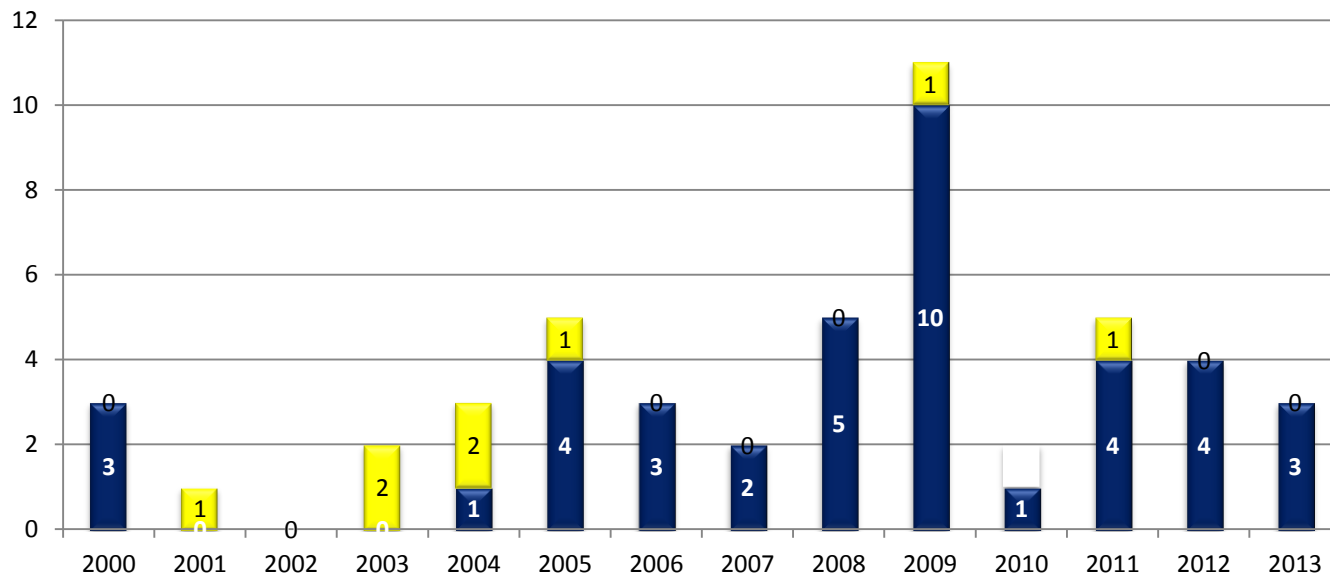
2000-2006

- 17 total reported events
- 6 injuries (all eye injuries)

2007-2013

- 31 total reported events
- 2 injuries (1 eye; 1 burn)

Laser Occurrences 2000-2013 YTD



Then and Now

SOR 2005-01

SPECIAL OPERATIONS REPORT: LASER SAFETY



U.S. Department of Energy

Office of Corporate
Performance Assessment

February 2005

www.eh.doe.gov/paa

Background

Laser accidents continue to occur across the DOE Complex. Seven laser accidents were reported in the Occurrence Reporting and Processing System (ORPS) over the past 5 years that resulted in eye exposures to six people. None of those injured was wearing the laser eye protection that is essential when working with high-energy laser systems. The purpose of this report is to examine the root causes and the corrective actions taken in response to these events; to evaluate the extent to which DOE laser safety requirements comply with ANSI Z136.1-2000, *American National Standard for Safe Use of Lasers (Safe Use of Lasers)*; and to provide laser safety performance expectations.

Lasers are used in the conduct of many DOE missions. There are several thousand laser systems in use, and more than 2,000 of these systems are Class 3B or 4. Furthermore, it is expected that the use of lasers will continue to increase with expanded future applications. Lasers are grouped into four classes based on their power and thus their potential for causing either injury or fires from direct exposure to the beam or reflections from diffuse reflective surfaces. The table below lists the four classes and describes the power of lasers in each class.

What we've learned and applied since 2005

Causes listed in '05 Special Report

- Inadequate training
 - Laser operators
 - Those that oversee
- LSOs conduct LTA
 - Part-time function
 - Varied training/experience
 - Lack of authority
 - Independent work

What we did to address this

- Training improvements
 - LLNL CBT – focuses on R&D use of lasers
 - Better mentorship
 - Hands on training (LANL example)
- LSO improvements
 - 7 labs have CLSOs
 - Workshop initiated in 2005
 - EFCOG launched 2009
 - Recognition by lab mgmt

What we've learned, continued

Causes listed in '05 Special Report

- Need for better internal oversight
 - Inadequate line mgmt oversight
 - Inadequate documentation
 - Laser audits LTA
- Personal Protective Equipment
 - Not wearing PPE
 - Not comprehending need for PPE
 - Inadequate engineering controls

What we did to address this

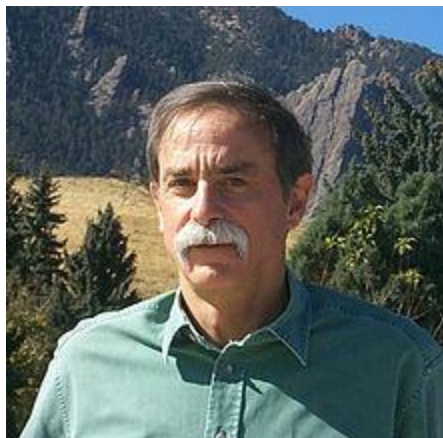
- Internal oversight improvements
 - Self assessments
 - SOP templates and review
 - 3rd party audits
- PPE improvements
 - Many labs have endeavored to enclose as many laser installations as possible
 - PPE last line of defense; training and availability

We've come a long way on our journey

- 2005 our LSO workshop had predominantly DOE lab folks, now look at us.
- A dynamic blend of research and safety discussions



- Keynote speakers like Charles Townes and David Wineland



Moving forward – as a community we need to continue to share:

- **Lessons learned**
- **Events**
- **How you keep your programs fresh**
- **How you keep your operators and managers engaged**
- **Mistake proofing methodologies**

- [Lessons Learned - DOE-SLAC-2012 - Laser eyewear protection inadvertently not used - 03/06/13](#)
- [Lessons Learned DOE-ANL-2008 Mislabeled Laser - 06/02/12](#)
- [Lessons Learned DOE-INL-2011 Hand Injury Report - 06/02/12](#)
- [Lessons Learned DOE-LLNL-2008 Diffuse Laser Light-Adjacent Labs - 06/02/12](#)
- [Lessons Learned DOE-LLNL-2008 Mislabeled Eyewear - 06/02/12](#)
- [Lessons Learned DOE-NNSA-Pantex-2011 Capacitor Shorted - 06/02/12](#)
- [Lessons Learned DOE-BNL-2003 Laser Injury Accident](#)
- [Lessons Learned DOE-LANL-2004 Injury Accident](#)
- [Lessons Learned DOE-Sandia-2007 Razor Blade Hand Injury](#)
- [Lessons Learned DOE-SLAC-2009 Laser Injury Accident](#)
- [Lessons Learned DOE-SLAC-2011 Laser Incident](#)