Volume 2
Issue 4

Laser Lessons News Letter

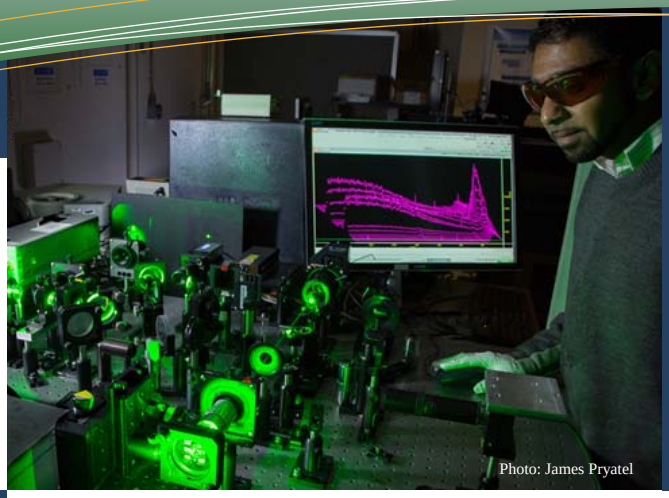
Photo: James Pryatel

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"…nothing should ever be taken for granted when performing a proper hazard analysis. When something does go wrong, the investigation will always lead to a series of contributing factors that aligned to cause the failure to occur. Assume nothing and remain forever vigilant." BE SAFE!

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Introduction

This is the final issue of Volume 2. These past two volumes have covered all topical areas for our laser safety training, including many lessons learned along the way. Regulations that govern laser use and our Laser Safety Program will be covered in this issue. Also included is a "lesson learned" review of the diode pump light incident we discussed in the previous issue and another on how *not* to use a laser pointer.

Regulations

Laser regulations are broken down into two categories:

- Manufacture
- Use

The manufacturing of lasers in the United States is governed by the Food and Drug Administration (FDA) under Title 21 of the Code of Federal Regulations (CFR), Parts 1010 and 1040. This is important to the end user (us) in that we want to be sure that lasers purchased meet the minimum safety requirements stated therein.

U.S. Food and Drug Administration
CENTER FOR DEVICES AND RADIOLOGICAL HEALTH

One very important element here is proper laser labeling. Sometimes, lasers may arrive from the manufacturer without labeling attached, but included with instructions to the end user (again us) to apply. This is becoming more commonplace as laser heads, and labels, get smaller and smaller. It is also very common with the purchase of laser pointers.

BE AWARE!

There are caveats or clarifications to the standard which are written in terms of "Laser Notices" from the FDA. Laser Notice 14 is *Applicability of Performance Standards to Products Manufactured by a Company for Use in its Manufacturing Process*.

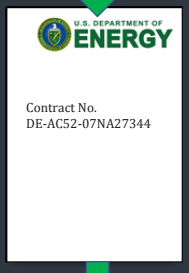
This Notice covers the applicability of the standard to a manufacturer of a laser. This comes down to whether or not the company is "engaged in business." A laser that is considered a "one-off," used at the location of its construction, is exempt from the standard. If the company was to build more than one of the said lasers and it (laser) was entered into commerce (sold) or was to be used by anyone other than those directly involved in its manufacture, the company would be considered "engaged in business" and required to comply with all requirements contained in the standard.

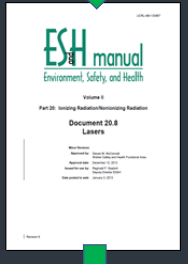
Laser Notice 25 is *Exemption of Certain Laser Products Used Exclusively by the Department of Energy and its Contractors*. This Notice covers the use of lasers procured from manufacturers that do not meet the requirements of 21CFR1040.10 and 1040.11.

In the case of this Notice, the end user is required to specially label said lasers and also provide the FDA with a list of the manufacturers and lasers procured under the exemption.

There is also one other DOE exemption letter from the FDA known as Exemption No. 78EL 01-DOE. This letter covers the exemption of lasers used exclusively by the DOE or their contractors at government owned contractor-operated (GOCO) facilities, and are used in a unique research application or are a component of a larger system, and are products of a model usually manufactured

Worker Regulations:
Flowdown





Work Control Document

(IWS/OSP/ Work Permit)

as certified laser products.

All of the above regulations relate to the "manufacture" of lasers. For you as the end user, it is not important that you be an expert on them, only that you understand that they exist. Your Laser Safety Officer (LSO) is your resource for the details.

It is important for you to know and understand the regulations that pertain to the "use" of lasers. For those, there are two sets of federal regulations. The first is 29CFR1926.54, which deals with the use of lasers in construction. The other is 10CFR851, which covers the DOE *Health and Safety Program*. This is the document that we use to operate our GOCO facility.

Our contract states that we must adhere to ANSI Z136.1 (2000) *for the Safe Use of Lasers*. This standard flows down into our *ES&H Manual* Document, 20.8 "Lasers." This is the document from which all other work control documents (Integration Work Sheet [IWS], Operational Safety Plan [OSP], Work Permit, etc.) are derived.

Another guidance document was released in 2012 and is currently under review for adoption. This is ANSI Z136.8 *for Safe Use of Lasers in Research, Development, or Testing*.

A review was recently performed by the Energy Facility Contractors Group (EFCOG) - Laser Safety Subgroup (LSSG) to compare ANZSI Z136.1 to ANSI Z136.8. There are some conflicts found between the two standards that should be ironed out with the release of the new ANSI Z136.1 due out in February 2014.

The report is now posted on the EFCOG LSSG web page. We will look to adopt either Z136.8 (2012) or the new Z136.1 (2014) in FY2015.

If you should ever need to operate a laser outdoors, you would need to comply with FAA7400.2. The Federal Aviation Administration has great concern in protecting pilots from laser strikes (Figure 1). ANSI Z136.6 *for the Safe Use of Lasers Outdoors* provides detailed guidance on these types of laser operations. Again, you need not know the details as much as understand that there are special requirements and your LSO can assist you if your laser operations take you out of the typical "four walls, a ceiling, and a floor" laser lab.

There are many other "additional standards" covering the safe operation of lasers besides those mentioned. Here is a list of the main ones:

- Z136 Series
  - .1 *Safe Use of Lasers*
  - .2 *Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*
  - .3 *Safe Use of Lases in Health Care*
  - .4 *Recommended Practice for Laser Safety Measurements for Hazard Evaluations*
  - .5 *Safe Use of Lasers in Educational Institutions*
  - .6 *Safe Use of Lasers Outdoors*
  - .7 *Testing and Labeling of Laser Protective Equipment*
  - .8 *Safe Use of Lasers in Research. Testing, and Development*
  - .9 *Safe use of Lasers in Manufacturing Environments*
- ANSI C7.2 *Recommended Practices for Laser Beam Welding, Cutting, and Drilling*
- ANSI B11.21 *Machine Tools Using Lasers for Processing Materials*
- NFPA Code 115 *Laser Fire Safety*

Figure 1. Laser Illuminated Helicopter in Egypt

Laser Safety Program

So far we've covered the regulations that govern our Laser Safety Program. The portion that is important to you and directly affects your work is Document 20.8, "Lasers." This document is imitative of Z136.1 (2000) and flows down requirements into Work Control Documents, which authorize your task(s) to be performed.

Document 20.8 does not apply to lasers incorporated into commercially-available devices that are used by the general public, unless these devices are opened, modified, or incorporated into a device built by or for LLNL, or are specifically addressed in the document. See 20.8 for specific examples.

To make for a more concise and useful work control document, you should read and understand Document 20.8 and apply that knowledge and understanding to prepare a succinct document that has controls pertinent to your operation.

With that, the controls are

applicable, to the point, and more apt to be read and followed by workers than a long and drawn out regurgitation of Document 20.8.

Overseeing the LLNL Laser Safety Program is the LSO/Laser Safety Subject Matter Expert (SME). This individual is responsible for evaluating anticipated laser hazards at a designated location of use and establishing control measures appropriate to those hazards for all potentially exposed individuals.

In most cases, the controls are implemented as follows:

1. Engineered
2. Administrative
3. Procedural
4. Training
5. Personal Protective Equipment (PPE)

The LSO also approves modifications of laser systems, the purchase of new lasers, and controls the transfer of lasers into and out of the Laboratory.

Deputy Laser Safety Officers (DLSOs) are assigned to specific work areas. The LSO may delegate responsibilities to each DLSO for their particular area. The LSO, along with DLSOs, can provide signage and labeling for your operations.
Other services provided are:

- Recommendations and approval to purchase Laser Protective Eyewear (LPE).
- Hazard evaluations and calculations.
- Assistance in implementing controls for your specific laser setup.

The laser safety points of contact are listed in the panel on the right.

Lessons Learned

Worker Exposed to Diode Pump Light

The previous issue covered an instance where a worker was exposed to diode array pump light through a gap in their LPE. As with any accident or near miss, there is always more than one contributing factor, or failure mode, leading up to the incident. This was no exception.

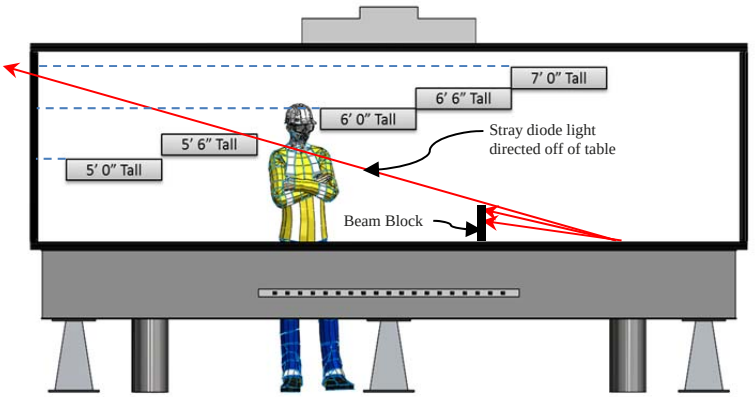


Figure 2. Laser hazard with respect to worker height

We explained that ill-fitting LPE caused the gap in the eyewear and focused on this as the cause. Looking a bit closer, we find that there were other failure modes along the way prior to that of the "the last line of defense" (LPE).

Let's take a look at the initial hazard analysis that determined the required controls. While a thorough analysis was performed, a failure occurred here when the analyzer assumed that there was no vulnerability out side of the physical height range.

This is something to give serious thought. We make numerous assumptions, most of which are based on our own life experiences. Many of these are physical, or how the world appears to us based on our physical standing. When analyzing any hazard requiring a control, remember to include people of all stature to ensure each is fully protected.

This failure led to the lack of a physical beam block/barrier being installed, which would have eliminated the stray light at the worker's location (height) (Figure 2). This lack of engineered control led to an increased reliance on lesser controls, LPE.

Relying on the LPE, led to failures on three different levels:

1. Selection
2. Use
3. Training

The failure in "Selection" was the assumption that this eyewear was the same as all other eyewear being used. The type of raised nosepiece on this model made it different and this was mistakenly overlooked.

That mistake led to the failure in "Use," allowing this LPE to be used for community, rather than assigned eyewear. During the lesson learned review, it was found that even slight variations in the physical structure of the nose made for dramatic changes in the fit of the LPE.

The last failure is one that is often overlooked in basic PPE, such as gloves and eyewear. This is "Training." Here, the worker failed to recognize that the gaps in the eyewear near the bridge of the nose were potentially hazardous. With this type of eyewear, special training should have been provided to ensure that a fit check recognized light gaps at the nosepiece along with around the brow, cheeks, and sides of the eyewear.

Who is your Laser Safety Point of Contact?

Jamie King, Laser Safety SME
NIF&PS Directorate

Larry Crowder,
GS/WCI

Kevin Goodwin,
PLS

Dave Hill,
WCI/Site 300

Sam Pogers,
NIF Site

Myron Reyes,
Engineering/PLS

As you can see from this, nothing should ever be taken for granted when performing a proper hazard analysis. When something does go wrong, the investigation will always lead to a series of contributing factors that aligned to cause the failure to occur. Assume nothing and remain forever vigilant. BE SAFE!

Improper Use of Laser Pointer

Albany Times Union - Jerome M. Hauer, Gov. Andrew Cuomo's director of homeland security, took out his handgun and used the laser sighting device attached to the barrel as a pointer in a presentation to a foreign delegation, according to public officials. It happened October 24 in Albany, New York at the highly secure state emergency operations center below State Police headquarters.

These officials, one of whom claimed to be an eyewitness, said that three Swedish emergency managers in the delegation were rattled when the gun's laser tracked across one of their heads before Hauer found the map of New York, at which he wanted to point.

Hauer, commissioner of the Division of Homeland Security and Emergency Services, isn't a law enforcement official. He carries the loaded 9-millimeter Glock in a holster into state buildings, an apparent violation of state law barring state employees from bringing weapons to the workplace, several witnesses say.

The incident with the Swedish delegation occurred during a two-hour briefing at the operations center concerning the state's response to Superstorm Sandy, according to one of the officials. According to one person who witnessed the scene in the conference room, which has mid-wall-to-ceiling windows so that people can see into the meeting space, two people opposite Hauer at the table moved quickly out of the line of the laser when he brought out the gun.

Laser Safety Workshop

10TH ANNUAL DEPARTMENT OF ENERGY LASER SAFETY OFFICER WORKSHOP

Save the date and plan to attend. We are proud to announce that LLNL/National Ignition Facility will be hosting the 10th Annual Department of Energy Laser Safety Officer Workshop August 19-21, 2014. This comprehensive workshop is for individuals with laser safety responsibility and interest in a research, industrial or academic setting who want to update and expand their laser safety knowledge. It features presentations on current laser applications and associated laser safety issues and solutions. Anyone interested in laser safety will not want to miss this unique workshop! The workshop also serves as the annual meeting of the U.S. Department of Energy Laser Safety Working Group (DOE - EFCOG).

The Workshop is a 2.5-day meeting and will include both invited and contributed talks. The keynote speaker will be Peter "Jeff" Wisoff, former astronaut and the Principal Associate Director for the National Ignition Facility and Photon Science Directorate. There will be a vendor exhibit and tours of the National Ignition Facility and Jupiter Laser Facility on the afternoon of August 20. The official workshop announcement along with the web page and call for abstracts is coming soon.

The initial workshop was conceived and held at LLNL in 2005 after the release of the *DOE Special Operations Report on Laser Safety*. The report pointed out several shortcomings with respect to Laser Safety Officers. Some items included training, refresher training, and networking amongst LSOs at the different DOE Laboratories. Ken Barat, LSO for NIF at the time, put together the first workshop and continued to organize them each year until his retirement from Lawrence Berkeley Lab in 2012. Starting in 2012 at SLAC, the workshop was brought under the LSSG of EFCOG and was formalized with Planning and Technical Program Committees. Previous hosting facilities include:

2006 – Brookhaven National Laboratory
2007 – Argonne National Laboratory
2008 – Sandia National Laboratory, co-hosted by Los Alamos National Laboratory
2009 – University of Pennsylvania
2010 – Lawrence Berkeley National Laboratory
2011 – Massachusetts Institute of Technology
2012 – SLAC National Accelerator Laboratory
2013 – National Institute of Science and Technology, Boulder, CO

The workshop has grown to become recognized as the premier venue for the discussion and sharing of practical laser safety information. STAY TUNED!