

THE UCONN LASER LINE

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Interesting Quote

"I guess you all know that the word laser is an acronym for Lots of Applied Scientists Eat Regularly, and some of them do."

-Dr. Arthur Schawlow, May 4, 1998



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The Purpose of the Laser Safety Newsletter.

It is our purpose to provide additional information to investigators to assist in protecting laboratory personnel and others who may be working in a laser environment. This may include lower priced vendors of protection equipment, or informative techniques that solve protection problems, or new training sites for information appropriate to

students. A description of laser accidents or tips for enhancing safety will also be presented. We feel it is important to extend the channels of communication beyond those of the regulatory or enforcement arena that enhance the safety environment. The newsletter will be published quarterly, or more frequently if the need arises.

What are the standard requirements for personal laser safety equipment?

Standard laser safety equipment can be generalized as products that remove or isolate the user and others from interaction with harmful radiation produced by high power lasers. Of these products, safety goggles, which remove enough of the harmful radiative energy from reaching the users eye, are primary.

In order to determine what personal laser safety equipment is needed, we must first look at the factors, which make the equipment necessary.

The Nominal Hazard Zone (NHZ) describes the space within which the level of the direct, reflected or scattered radiation during operation exceeds the applicable Maximum Permis-

sible Exposure (MPE). In our case, at the University of Connecticut, we consider the NHZ to encompass the entire lab in which the laser is present, along with any areas were the inside of the lab is visible.

The MPE limits of radiation from lasers are calculated based on a standard calculation for the specific operational features of the laser in question. MPEs are dependent on wavelength and exposure duration. However the MPEs become more stringent as the pulse duration decreases and the eye has less chance to dissipate heat from shorter pulses. The MPE for a specific wavelength and exposure duration can be found in the American National Standard Institute (ANSI) book for safe use

of lasers, a standard otherwise known as ANSI Z136.1-2000.

Now that we have looked at some of the factors involved in determining if the equipment is necessary we can determine the specifications required of laser safety goggles.

Laser safety goggles are rated based on their optical density (OD) at specific wavelengths. The optical density of a particular set of goggles is calculated by the following equation for each wavelength:

$$OD_{\lambda} = \frac{A_{\lambda}}{l} = -\frac{1}{l} \log_{10} T = \frac{1}{l} \log_{10} \left(\frac{I_0}{I} \right)$$

Where:

l = the distance that light travels through the sample (cm)

A_{λ} = the absorbance at wavelength λ .

T = the per-unit transmittance

I_0 = the intensity of the incident light

I = the intensity of the transmitted light

As we know, there are no true units for absorbance, typically reported as absorbance units (AU), and since they are related to the OD in this way, therefore, there are no true units for OD and are typically reported in OD units (ODU), which is equal to AU cm^{-1} .

In order to determine the appropriate goggle OD required for a laser user the following calculation is done which relates the MPE to goggle OD.

$$OD = \log_{10} \frac{H_0}{MPE}$$

Where:

H_0 = The anticipated worst case exposure (in J/ cm^2 or W/ cm^2)

MPE = The MPE expressed in the same units as H_0 .

The laser safety officer calculates these parameters via a computer program which allows simultaneous computation of multiple factors based on specific information re-

ceived in the standard operating procedures supplied by the various laser users at UCONN. The program is called Lazan, supplied by the Laser Institute of America (LIA), and is a practical tool for laser safety calculations.



Traffic Control in Laser Labs

Principal Investigators (PIs) and laser supervisors often implement policies specifying who is authorized to be present while open-beam laser systems are in use. Ideally, the only individuals who should be permitted access are the ones actually required to perform the studies. However, it is not uncommon to find other people in the immediate area while laser studies are underway. Laser operators are much more aware of the potential hazards presented by a laser manipulation and with the required safety procedures than random observers, who have had no training nor experience with lasers.

PIs and laser supervisors need to restrict access to laser laboratories while open-beam laser systems are operating. This requires keeping doors to laser laboratories locked and limiting keys to those doors to authorized personnel only. Visitors must be excluded whenever any significant risks to the uninitiated and unprotected exist. If janitors will be entering laser laboratories, accommodations for their presence must be made in advance. Master lockout keys should be removed from lasers when conditions warrant it.

Installation of New Laser Warning Lights.

The existing door warning lights consisting of blinking blue bicycle lights will be changed to red flashing lights. The old systems will be replaced at the time of an inspection or sooner if required. If you require an immediate replacement, call Dawn at Radiation Safety at 6-1105 or send an e-mail request to the LSO at martin.graham@uconn.edu

Laser Safety Committee

The Laser Safety Committee (LSC) is comprised of members appointed by the Associate VP for Public & Environmental Safety. It shall be composed of University faculty and staff laser users, a representative of the University Administration, and Environmental Health & Safety Department representatives including the designated Laser Safety Officer. It has jurisdiction over safety issues related to laser equipment and activities at all campuses of the University of Connecticut with the exception of the University of Connecticut Health Center.



Submission of SOPs

Contact Dr. Martin Graham...

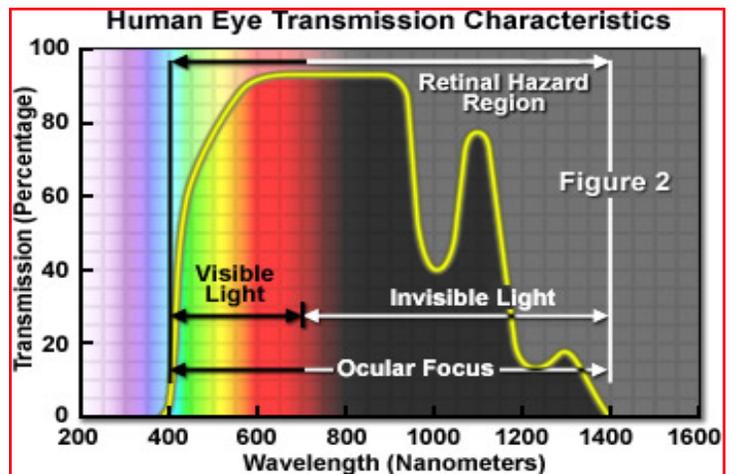
Email: martin.graham@uconn.edu Phone: 486-1108

Laser Safety Training on WebVista

...you will need to provide your net ID. Please Contact Dawn Kemp at 486-1105 or dawn.kemp@uconn.edu.

Need to Have an Eye Exam?

Schedule a free laser baseline eye examination; why not, it can't hurt, Right? Please contact Ms. Janice Copeland at Student Health Services, 486-0748



Informative links

<http://www.ehs.uconn.edu/radi.htm>

<http://www.microscopyu.com/articles/fluorescence/lasersafety.html>

<http://www.laserinstitute.org>

References

- American National Standard Institute. American National Standard for Safe Use of Lasers. ANSI Z136.1-2000
- Laser Institute of America. Laser Hazard Evaluator. Version 2.04