



# Laser Safety Challenges at the University of Illinois at Urbana-Champaign

Anja Metz

Division of Research Safety

University of Illinois at Urbana-Champaign





# Introduction

## Laser Use at the University of Illinois:

- ~ 500 lasers (class 3b to high-power class 4)
- ~ 90 Principal Investigators (PI) using lasers in ~ 20 departments
- No centralized information exchange with purchasing
- Some PIs build their own lasers or modify commercial ones
- Most lasers are used in research laboratories, very few medical applications





# Requirements

Requirements by IL regulations:  
(IL Emergency Management Agency IEMA)

- Laser Registration
- The LSO needs to know:  
MPE for every laser under all conditions of use
- The LSO needs to ensure that all laser systems in operation meet the requirements and that control measures are in effect

## Challenges

We are not informed when someone buys a laser

We cannot possibly know all conditions of use. Conditions also change frequently

Systems are modified frequently





# Laser Safety Program

Managed by DRS with support and guidance from the Radiation and Laser Safety Committee.

We require:

- Registration of all Class 3b and Class 4 Lasers
- Initial training and annual training  
(we offer an online training but do not require it)
- Implementation of control measures by PI according to IEMA regulations

We do not issue permits or approve laser use. Instead, we check compliance during audits.





# Laser Safety Program

In the past:

- Laser Registration on paper / email
- Laser inventory in MS Access® database
- PI did not have access to their laser inventory

Problems:

Lasers disappeared, new ones appeared with no registration, lasers move from lab to lab, from PI to PI. Some lasers were registered twice.

Difficult to maintain an accurate inventory.





# Laser Safety Program

In the past:

- Laser lab audits every 2 years
- Audit on paper/email
- No feedback if corrective actions were taken

Problems:

Often, a lot of change within 2 years at a university.  
Deficiencies were not always corrected.





# Laser Safety Program

Now:

- Laser Registration online. PIs add lasers directly to the online database.
- PIs and their safety contacts have access to their laser inventory. Status changes, room changes, transfers can all be done online without contacting us.
- We receive an email when a laser is added, deleted or transferred.





# Laser Safety Program

## Lasers

[Show Disposed Inventory](#)

[Add a Laser](#)

0 1 2 3 4 5 6 7 8 9 A B C D E F G H I J K L M N O P Q R S T U V W X Y Z

(x) Clear Filter Export to Excel

Drag a column header and drop it here to group by that column

Locations Used/Stored at	Used by	Class	Model	Serial Number	Wavelengths	DRS #	In Use	Actions
Seitz Materials Research Lab, 108	van der Veen, Renske	4	VPFL-6-10-HE	Unknown	530-540 nm	359	Yes	
Chemical & Life Sciences Laboratory, A223	Groebels, Martin	4	Ti-Sapphire	122	700-900 nm	93	Yes	
Loomis Laboratory of Physics, 358	Kwiat, Paul	4	Tsunami PN3941-30-M1S	2607	810-810 nm	224	Yes	
Loomis Laboratory of Physics, 362	Kwiat, Paul	3b	N/A	0766EF	632.8-632.8 nm	227	Yes	
Beckman Institute, 3420	Bharjaya, Rohit	3b	Invictus	N/A	785-785 nm	25	Yes	
Computing Applications Building, B71	Eassi, Jay	4	190C	510412103	488-488 nm 514-514 nm	127	No	
Loomis Laboratory of Physics, 471	Beck, Douglas	3b	TLB 6704 P	0352	635-638 nm	247	Yes	

## Laser Inventory





# Laser Safety Program

## Laser Entry

### Equipment Description

Manufacturer:

Access Laser Company ▼

Model:

12345  I don't know the model.

Serial Number:

78945  I don't know the serial number.

### Laser System Description

Laser Class:

3b ▼

Laser Type *(Check all that apply):*

Continuous Wave (CW)

Pulsed

Lasing Medium:

DPSS ▼

Min. Wavelength:

Max. Wavelength:

Wavelength Units:

Nanometers ▼

Power:

Power Unit:

-- Select a Unit -- ▼

Optical Density:

Add Wavelength

Min. Wavelength	Max. Wavelength	Wavelength Unit	Power	Power Unit	Optical Density	
<input type="text" value="488"/>	<input type="text" value="488"/>	Nanometers ▼	<input type="text" value="50"/>	mW ▼	<input type="text" value="2"/>	✘

Emerging Beam Divergence:

1.5  M<sup>2</sup> ▼

Laser Beam Type:

Circular ▼

Primary Beam Dimension:

5  millimeter ▼



# Laser Safety Program

Now:

- Laser audits every year included in the General Lab Safety Audit.
- Audits are online.
- PIs and their safety contacts are notified when the report is available.
- PI and safety contact can respond in the online form.
- We see responses.
- Reminder emails are sent out automatically if findings remain unresolved.





# Laser Safety Program

## I. Administrative Controls

A. All lasers registered with DRS

Sat  Unsat

+ Details

B. Lab Safety Plan covers laser operation, alignment and policies

Sat  Unsat

+ Details

Comments

Develop a SOP for laser operation, policies and alignment.

ImageData

No file chosen

C. Alignment procedure calls for minimum power/energy

Sat  Unsat

+ Details

D. Personnel have completed annual training

Sat  Unsat

+ Details

E. Area appropriately posted

Sat  Unsat

+ Details

F. All lasers and protective barriers are labeled

Sat  Unsat

+ Details

## II. PPE

A. Adequate eye protection available

Sat  Unsat

+ Details

B. Eye protection in good condition

Sat  Unsat

+ Details

C. Eye protection suitable for specific wavelength(s)

Sat  Unsat

+ Details

D. Optical density of eye protection adequate

Sat  Unsat

+ Details

E. Eye protection worn inside the Nominal Hazard Zone

Sat  Unsat

+ Details

F. Semi-annual eyewear inspection documented

Sat  Unsat

+ Details

G. Adequate PPE is available for class 4 lasers (gloves, clothing, or shields)

Sat  Unsat

+ Details

## III. Engineering Controls

A. Protective housing in place

Sat  Unsat

+ Details

B. Safety interlocks perform as intended

Sat  Unsat

+ Details

C. Laser mounted on optical bench or other stable platform

Sat  Unsat

+ Details

D. Beam is not at eye level

Sat  Unsat

+ Details

E. Beam control is adequate

Sat  Unsat

+ Details

F. Warning system available (visual or aural)

Sat  Unsat

+ Details

G. Entryway control is present (interlock or blocking barrier)

Sat  Unsat

+ Details

Laboratory audit form filled out by DRS staff





## Laser Audit - 5/2/2016

### Summary

Principal Investigator

Date of Audit  
5/2/2016

Audits Done  
Laser Audit

3 of 3 issues have been addressed.

### Labs

Seitz Materials Research Lab, Room

### Audit Finding Details

You must hit "Save" at the bottom of this page to save your results.  
Please work with your facility manager to resolve any issue marked as a facility issue.

#### Administrative Controls

##### 1. Lab Safety Plan does not sufficiently cover laser operation, alignment and policies

Develop a SOP for laser operation, policies and alignment.

Issue Addressed

Describe how the issue was addressed.\*

Laser operation, policies, and alignment SOP has been developed.

##### 2. Personnel have not completed annual training

Issue Addressed

Describe how the issue was addressed.\*

Annual Laser safety training has been completed

#### PPE

##### 1. Semi-annual eyewear inspection is not performed or not documented

Issue Addressed

Describe how the issue was addressed.\*

Eyewear inspection routine has been implemented.



# Laser Audit Findings

Common findings we found over the years:

1. SOP/Alignment procedure not available
2. Semi-annual eyewear checks not documented
3. Training not repeated annually
4. Eyewear not adequate (wrong wavelength, OD, broken or modified)
5. Warning system not available





# Laser Audit Findings

Example of  
good eyewear  
storage





# Laser Audit Findings



Example of modified eyewear to serve two wavelengths





# Laser Safety Issues

Other issues we encountered over the years:

Unresponsive PIs.

One eye injury, PI said the student did not do anything wrong.



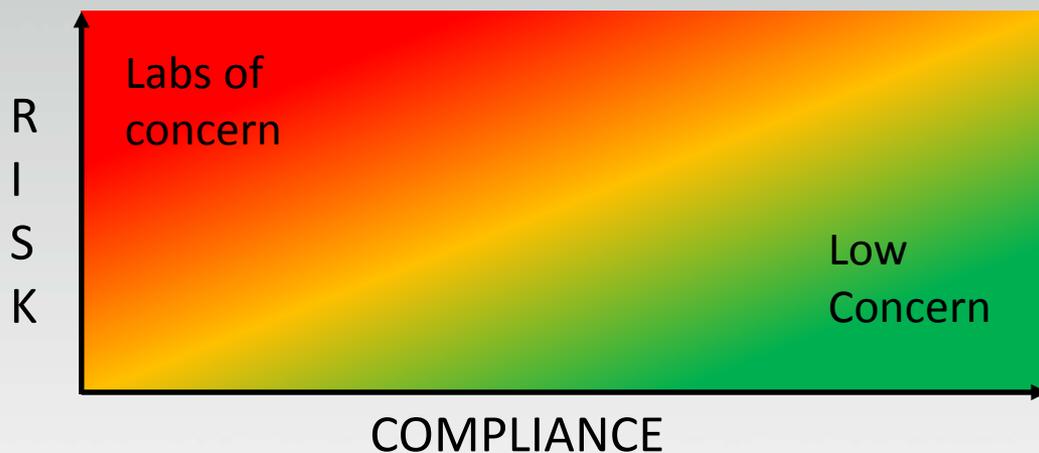


# Safety versus Compliance

Question? Is laser use at UIUC safe or compliant?

Some labs have many findings but low risk research

Other labs are compliant but do high risk research





# Increasing Compliance

How can we make labs more compliant?

- Make it easier for them to comply
- Frequent reminders
- Remind PIs of their responsibility
- Involve committee

We hope our new audit process and online database will:

- Keep inventories more current
- Improve compliance by being more present





# Increasing Compliance

How can we (the LSO) be more compliant?

- Perform hazard analysis for worst case conditions
- Calculate OD values and add them to the database
- Ask labs for inventory updates before annual reporting to IEMA





# Improving Safety

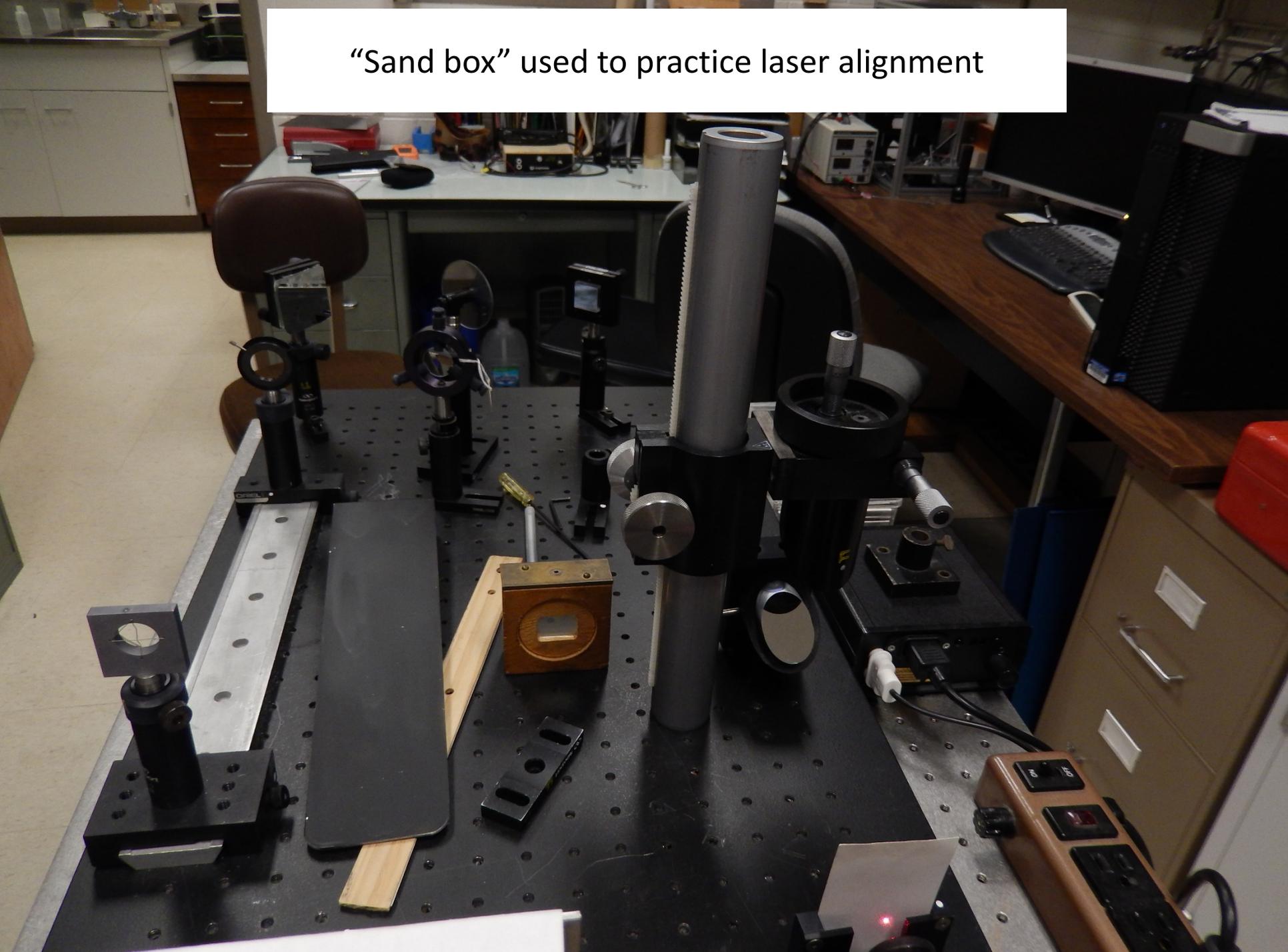
Will increasing compliance make laser use safer?

To some extent, yes. **But**, safe work practices require good training including hands on training!

- Improve online training and require it
- Use the audit for training where necessary
- Encourage sandbox training options for laser alignment



“Sand box” used to practice laser alignment





# Conclusion

- The LSO cannot know and approve of every laser use.
- We need to rely on PIs and their students to implement sufficient control measures.
- This requires training and awareness of their responsibility.
- Regular audits are necessary to improve compliance and safety.





# Acknowledgements

Thank you for listening.

Special thanks go to Julio Soares for good advice and pictures.

Questions?

