

Laser Safety Standard Operating Procedure

Building / Room Number: [insert building number] / [insert room number(s)]

Division / Department: [insert name of division] / [insert name of department]

Author: [insert name], System Laser Safety Officer

Date Completed: [insert date]

Version Number: [insert version number]

To use this template:

1. Save the file (File>Save As), using your own filenaming convention
2. Update headers and footers by typing over document control text where indicated:
[something] (View>Header and Footer)
3. Complete the body by adding text where indicated: [Add text]
4. Add sections by typing the text and assigning the proper heading style to the heading (Heading 1, Heading 2, and so on) (Format>Styles and Formatting, Available Styles).
Do not type over the table of contents, it is generated automatically.
5. Update table of contents (Edit>Select All, F9)
6. Save the file again (File>Save)

Once the SOP is approved, send the signed copy and a link or the file itself to the SLAC laser safety officer.

Approval

Program Manager

Name	Signature	Date
System Laser Safety Officer		

Name	Signature	Date
SLAC Laser Safety Officer		

Name	Signature	Date

Laser Safety: Standard Operating Procedure Template

Department: Chemical and General Safety

Program: Laser Safety

Owner: Program Manager

Authority: ES&H Manual, Chapter 10, Laser Safety¹

¹ *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 10, “Laser Safety”, http://www-group.slac.stanford.edu/esh/hazardous_activities/laser/policies.htm

Table of Contents

1	Introduction	5
2	Facility Description	5
3	Personnel	5
	3.1 Laser Operators	5
	3.2 Laser Service Subcontractors	5
	3.3 Visitors	5
4	Description of Hazards	5
	4.1 Lasers	6
	4.1.1 Hazard Classification and Parameters Description	6
	4.1.2 Laser Controlled Areas and Nominal Hazard Zones	6
	4.2 Electrical	6
	4.3 Toxic materials	6
	4.4 Other	7
5	Hazard Controls	7
	5.1 Engineering Controls	7
	5.1.1 Laser Safety System	7
	5.1.1.1 Logic and Controls	7
	5.1.1.2 Status Indicators	8
	5.1.1.3 Shutters and Stoppers	8
	5.1.1.4 Interlocks	8
	5.1.1.5 Crash Buttons	8
	5.1.2 Keys	8
	5.1.3 Emergency Entry and Exit	8
	5.1.4 Beam Path Definition and Control	8
	5.1.4.1 Table Enclosures	8
	5.1.4.2 Beam Termination	9
	5.1.4.3 Other Enclosures	9
	5.1.5 Signs and Other Visual and Audible Warnings	9
	5.2 Administrative Controls and Procedures	9
	5.2.1 Normal Operation and Procedures	9
	5.2.2 Alignment Operation and Procedures	9
	5.2.3 Laser Maintenance Operation and Procedures	9
	5.2.4 Laser Repair Operation and Procedure	10
	5.2.5 Lock and Tag Procedures	10
	5.3 Personal Protective Equipment	10
6	Training	11
	6.1 Laser Operators	11
	6.2 Laser Service Subcontractors	12
	6.3 Visitors	12
7	Administration and Documentation	12

1 Introduction

Describe the overall facility. Include items that will not appear elsewhere such as purpose, management, and physics goals.

[Add text]

2 Facility Description

Describe the physical facility: the location, building, room. Provide a figure showing the layout of the laser room, include lasers with optical paths and important components. Include locations of important safety components: shutters, Emergency Off buttons, control panels, and/or key switches, micro-switches.

[Add text]

[Add figure]

3 Personnel

Briefly describe the different types of personnel that can access the facility and any additional personnel types.

[Add text]

3.1 Laser Operators

[Add text]

3.2 Laser Service Subcontractors

[Add text]

3.3 Visitors

[Add text]

4 Description of Hazards

Describe each laser and its important characteristics.

[Add text]

4.1 Lasers

[Add text]

4.1.1 Hazard Classification and Parameters Description

Provide a table of all important parameters

[Update table]

Laser ID	Wavelength (nm)	Average Power	Pulse Length	Pulse Energy	Pulse Repetition Rate	Beam Size	OD Req.	ANSI Class
Tsunami (Oscillator)	800 nm	750 mW	80 fs	9.5 nJ	79 MHz	2mm	3.1	4

4.1.2 Laser Controlled Areas and Nominal Hazard Zones

Describe the laser controlled areas (LCAs) and provide a figure. (These can be identified in the figure in Section 2, “Facility Description”, but should be given specific attention here). In general the nominal hazard zones (NHZ) will be the entire LCA. The details of how the hazards within the NHZ are mitigated will be covered in Section 5, “Hazard Controls”.

[Add text]

[Add figure]

4.2 Electrical

Briefly describe the electrical hazards and mitigation. Reference documents presented to Electrical Safety Committee with date of approval if available or pending.

[Add text]

4.3 Toxic materials

Describe toxic materials if any. Include possible laser generated air contaminants. Reference documents presented to Hazardous Experimental Equipment Committee with date of approval if available or pending.

[Add text]

4.4 Other

Describe other hazards (for example, radiation) if any. Reference documents presented to Safety Overview Committee with date of approval if available or pending.

[Add text]

5 Hazard Controls

5.1 Engineering Controls

Describe all the engineering controls used to mitigate the hazards. The laser safety system (LSS), beam path control, and warnings are included but add additional sections if necessary.

[Add text]

5.1.1 Laser Safety System

Describe the laser safety system (LSS) in sections 5.1.1.1 through 5.1.1.5. Some systems may require additional sections for a complete description.

A minimum of one interlocked and one locked door is required for entry into an LCA.

It is desirable to have the LSS illuminate a sign requiring personal protective equipment (PPE) when the LSS master controller is enabled.

[Add text]

5.1.1.1 Logic and Controls

Describe the logic and controls system.

Each LCA is required to have a master controller, which permits laser light in the LCA above the maximum permissible exposure (MPE) level. The master controller must be located inside the LCA if personnel are to work in the LCA with the laser on. The master controller can only be enabled by a master key/access code that is restricted to approved laser operators. The master key/access code must satisfy the conditions in Section 4.3.4 in ANSI Z136.1-2000.² When the master controller is enabled, protection eyewear PPE must be worn in the LCA as specified in this SOP.

[Add text]

2 American National Standards Institute (ANSI) Z136.1-2000, "Safe Use of Lasers" (ANSI Z136.1-2000). See the "SLAC Research Library Community Pages", <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards. This standard is available in hard copy, QC483:A55:2000, <http://www.slac.stanford.edu/spires/find/books/wwwbookcirc?key=280640>.

5.1.1.2 Status Indicators

The use of color indicators in the LSS to convey information should be carefully considered since the colors may change with the use of laser goggles.

[Add text]

5.1.1.3 Shutters and Stoppers

[Add text]

5.1.1.4 Interlocks

[Add text]

5.1.1.5 Crash Buttons

Describe the location of each Crash Off button and the exact action taken by the LSS when each button is activated.

Crash Off buttons must be latched.

[Add text]

5.1.2 Keys

List all laser room keys, laser keys, and master keys. Describe where keys are stored and who distributes them.

Keys are only to be issued or accessible to fully trained laser operators.

[Add text]

5.1.3 Emergency Entry and Exit

[Add text]

5.1.4 Beam Path Definition and Control

[Add text]

5.1.4.1 Table Enclosures

Describe the method of containing the beam on the table. This includes table skirts, covers, and beam tubes if applicable.

[Add text]

5.1.4.2 Beam Termination

Describe the acceptable method to stop or terminate the laser beam.

[Add text]

5.1.4.3 Other Enclosures

Describe the use of any other enclosures such as transport tubes.

[Add text]

5.1.5 Signs and Other Visual and Audible Warnings

Describe any signs or LSS warnings that are not described above.

[Add text]

5.2 Administrative Controls and Procedures

Describe all the administrative controls used to mitigate hazards. Add additional sections if necessary.

[Add text]

5.2.1 Normal Operation and Procedures

*Describe normal operating mode(s). Describe normal activities and PPE required. **Emphasize the description of conditions under which PPE is required.** Describe procedures to change from one activity or mode to another. Describe entry and egress procedures. Describe start up and shut down procedures.*

[Add text]

5.2.2 Alignment Operation and Procedures

*Describe expected alignment activities and special procedures necessary. Describe authorized personnel, special PPE, and so on. **Emphasize the description of conditions under which PPE is required.** Describe procedure to commence and terminate this operation.*

[Add text]

5.2.3 Laser Maintenance Operation and Procedures

*Describe authorized personnel, supervision, special procedures. Describe procedure to commence and terminate this operation. **Emphasize the description of conditions under***

which PPE is required. Describe compliance with the SLAC Control of Hazardous Energy Program (for example, during flashlamp changes).

[Add text]

5.2.4 Laser Repair Operation and Procedure

*Describe authorized personnel, supervision, special procedures. Describe procedure to commence and terminate this operation. **Emphasize the description of conditions under which PPE is required. Describe compliance with the SLAC Control of Hazardous Energy Program.***

[Add text]

5.2.5 Lock and Tag Procedures

While servicing electrical or experimental equipment, the work must comply with SLAC's Control of Hazardous Energy Program.

[Add text]

5.3 Personal Protective Equipment

Describe the required personal protective equipment (PPE) for this laser laboratory.

Only PPE approved by the system laser safety officer (SLSO) and SLAC laser safety officer (LSO) is permitted.

Operating Class IIIb or IV lasers will require some form of PPE to protect eyes and skin, such as laser goggles, face shields, or gloves.

PPE is to be inspected each time it is used and discarded if scratched or otherwise damaged, in accordance with ANSI standards.

There is not a standard laser goggle frame in use at SLAC. System laser safety officers are free to choose frame styles but they must have side shields or wrap around. The manufacturer provided optical density (OD) of the filters supersedes information printed on the goggle.

It is recommended to use a single goggle style in each laboratory. In those cases where a single goggle is not possible the number of goggle styles should be minimized. The different styles should be easily distinguishable to avoid confusion of which goggle is used for which application. The detailed procedure for switching goggles must be included in the SOP.

[Add text]

6 Training

All personnel must have proper training documented in their SLAC Training Assessment (STA)³ and all hazards analyzed in their job hazard analysis and mitigation (JHAM).⁴ The training listed in the SOP does not alleviate those requirements and is a subset of the training in the STA. The training listed below is only sufficient for operating the lasers described in this SOP.

6.1 Laser Operators

A laser operator is trained to operate or use the lasers and/or associated optical, electronics, and controls components in the laser room safely. Laser operators require at minimum the training listed below. Additional site specific training may be required such as CPR, electrical safety, lock and tag, laser specific alignment procedures, etc. The additional training requirements are to be set by the SLSO, SLSO supervisor and the area manager. Training requirements can differ for different operators depending on the tasks they are approved to perform. In order to operate the lasers the operator must also be authorized by the SLSO.

Required training for laser operators includes

1. Taking ES&H Course 253, Laser Worker Safety⁵
2. Taking ES&H Course 253ME, Laser Worker Baseline Medical⁶
3. Reading *ES&H Manual*, Chapter 10, “Laser Safety”⁷
4. Being familiar with the laser ANSI standards (Z136.1)⁸
5. Reading and understanding the laser facility SOP
6. Reading the building area hazard analysis (AHA)⁹
7. Receiving on-the-job training from the SLSO

3 “Training - SLAC Training Assessment”, <http://www-group.slac.stanford.edu/esh/training/sta/default.htm>

4 “Job Hazard Analysis”, <http://www-group.slac.stanford.edu/esh/general/hazanalysis/jham.htm>

5 ES&H Course 253, Laser Worker Safety, https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=253

6 ES&H Course 253ME, Laser Worker Baseline Medical, https://www-internal.slac.stanford.edu/esh-db/training/slaonly/bin/catalog_item.asp?course=253ME

7 *SLAC Environment, Safety, and Health Manual* (SLAC-I-720-0A29Z-001), Chapter 10, “Laser Safety”, http://www-group.slac.stanford.edu/esh/hazardous_activities/laser/policies.htm

8 American National Standards Institute (ANSI) Z136.1-2000, “Safe Use of Lasers” (ANSI Z136.1-2000). See the “SLAC Research Library Community Pages”, <http://www-group.slac.stanford.edu/library/CommunityPages.asp>, for available standards. This standard is available in hard copy, QC483:A55:2000, <http://www.slac.stanford.edu/spires/find/books/wwwbookcirc?key=280640>.

9 “Area Hazard Analysis”, <http://www-group.slac.stanford.edu/esh/general/hazanalysis/aha.htm>

8. Meeting with and being approved by the SLAC LSO

6.2 Laser Service Subcontractors

A laser service subcontractor may need to be in the laser lab to perform maintenance or repairs. This non-SLAC employee is required to follow SLAC safety requirements for service subcontractors. Their laser safety training is provided by their employer and SLAC is only responsible for providing site-specific safety training. The requestor for such laser service work must follow SLAC procedures for service subcontractors and obtain approval from the laser safety officer for the work to be done. Subcontractor personnel are allowed access to the laser lab only while escorted by a qualified laser operator. The subcontractor is required to read the building AHA, to understand all the hazards associated with the lab, and abide by the same safety procedures as laser operators.

6.3 Visitors

Visitors are any personnel not described in Section 6.1, “Laser Operators”, or Section **Error! Reference source not found.**, “Laser Service Subcontractors”. In general, they are allowed to be present in an LCA only when the LSS master control panel for that LCA is disabled (for example by removing its master key). If the LSS master control panel is enabled, visitors can be allowed in an LCA only under the following conditions:

1. Visitors must complete a system visitor form and obtain approval from the SLSO.
2. The visitor will be escorted at all times by a qualified laser operator, who will ensure that proper eyewear is worn.
3. The escorting qualified laser operator will ensure the laser is in and will stay in a state of minimal hazard during the visit. No laser alignment work is allowed during the visitor’s presence in the lab.
4. All visitors must be 18 years of age or older.
5. Visitors are not allowed to operate the lasers or to manipulate the laser beams.

7 Administration and Documentation

The SLSO will maintain a system laser safety binder available at the laser laboratory. The safety binder must include this document with approval signatures, documentation for authorized approval to operate the system, and the following:

1. Documented laser operator training, including on-the-job training
2. Documented laser inventory
3. Documented key inventory, including LCA room keys, laser keys, and master keys
4. Documented visits by manufacturer/supply engineers and visitors
5. Documented LSS interlock tests and certification

Tests and certification are required every 12 months; documentation for these tests and certification must be kept by the SLSO in the system safety binder.

Either include the LSS certification procedure (if the procedure is simple) or cite, including title, file location, and document number, if any. Certification procedure should include inspection of shutters/stoppers for damage. Explain how the procedure is validated, who is authorized to certify the system and how often the system is recertified.

[Add text]