

LASER SELF AUDIT

For all Class 3R, 3B, and 4 lasers and laser systems, this form must be completed and submitted to the Laser Safety Officer (LSO) once a year to prepare for the annual laser safety inspections. Please maintain a copy of the completed form for your lab records.

Contact the LSO at dcon@vt.edu or call 540-231-5364 for further questions.

***An appendix with descriptions of each control measure can be found at the end of this document.*

LAB INFO

Laser Owner / PI: _____

Date: _____

Email: _____

Audit Performed By: _____

Building & Room #: _____

LASER INFO

Manufacturer: _____

Laser's Name: _____

Model: _____

Lass Type: _____

Serial #: _____

Laser Class: _____

A. Engineering Safety Controls:

YES NO N/A

Notes:

Laser & Optics Set Up				
			1. Laser generating machine and optics secured	
			2. Beam path not at eye level & not directed towards windows/doors	
			3. Appropriate beam stops or attenuators in place (Class 3R, 3B, 4)	
			4. Laser equipped with beam shutter (Class 3B, 4)	
			5. No reflective materials in beam path	
Laser Access & Viewing				
			6. Protective housing with interlock present	
			7. Laser viewing optics designed to protect user from direct exposure	
			8. Windows/door viewing panels covered with laser absorbing materials	
			9. Laser protective barriers or curtains present & in good condition	
Laser Initiation & Warning Systems				
			10. Emergency stop/key or master switch present (Class 3B or 4 – key or coded access); Key should NOT be stored in the system.	
			11. Emission indicator system present and working (Class 3B or 4)	
			12. Activation warning system present and working (Class 3B, 4)	

B. Administrative & Procedural Controls:

YES NO N/A

Notes:

Training & Operating Procedures				
			1. Training complete & up-to-date for all persons operating the laser	
			2. Laser SOP is up to date, accessible, and signed by all users in lab (required for Class 3R, 3B, and 4 lasers and laser systems)	
			3. Laser beam alignment procedure present and accessible	
			4. Laser safety manual present and accessible	
Warning Signs & Labels				
			5. Warning label on laser to indicate class and power	
			6. Laser Control Area posted with appropriate warning sign (Class 3R, 3B, and 4 lasers and laser systems; SOP should specify)	
			7. Door signs w/ power of the laser posted on all doors leading to laser	
			8. Lab specific safety guidelines posted	
			9. Emergency contact list posted	
			10. Fiber optics connector tag present	

C. Personal Protective Equipment:

YES NO N/A

Notes:

			1. Proper laser eye protection available & in good condition (Class 3R, 3B, 4)	
			2. Laser protective eyewear has correct Optical Density (OD) & correct wavelength	
			3. PPE for UV exposure available when necessary	

D. Non-Beam Hazards:

YES NO N/A

Notes:

Common Non-Beam Hazards				
			1. Electrical hazard control measures properly implemented (i.e. High Voltage Power & Optical tables, etc; should be specified in SOP)	
			2. Collateral and/or plasma radiation hazard control measures are properly implemented	
			3. Fire/ explosion hazard control measures are properly implemented	
			4. Compressed gas hazard control measures are properly implemented	

YES NO N/A

Notes:

SOP Specific Non-Beam Hazards				
			5. Any additional SOP specific, non-beam hazards control measures are properly implemented. Consider: - laser dye and/or solvent hazards - laser generated airborne contaminants - cryogen hazards - biological agent hazards	

E. Documentation:

YES NO N/A

Notes:

			1. All Class 3R, 3B, and 4 lasers registered with EHS	
			2. All SOP's and alignment procedure submitted to EHS	
			3. LSOP Training Record is present/accessible at the time of inspection	
			4. Required Laser Safety Records (LSOP & Training Record) are present for audit (clearly labeled binder in central location)	

Additional Comments:

Certification: (to be completed by each person submitting the information requested on this form)

By signing this form, I certify that all information on this form and additional supporting information submitted with this form are true and complete to the best of my knowledge.

 Auditor Signature

 Date

Appendix

A. Engineering Safety Controls

1: Laser generating machine & optics secured to prevent stray beams.

All laser generating machines should be secured to avoid any accidental change in direction of beam path. All optics used in a procedure should be secured to prevent any stray beams.

2: The beam path is not at eye level or directed towards windows or entry points.

The laser beam height should be maintained at the appropriate height that is not at eye level for sitting or standing persons. The laser beam must be oriented such that it is not directed at windows, across corridors or at LCA entry points.

3: Appropriate beam stops or attenuators in place (Class 3R, 3B, 4).

Potentially hazardous beams should be terminated by a permanently attached beam stop or attenuator. The beam stop should be non-reflecting and fire-retardant.

4: Beam shutters in place (Class 3B, 4).

Lasers should be equipped with a beam shutter that covers the aperture. The shutter should completely stop the laser beam. Black, non-reflective material is desirable.

5: Reflective material removed from laser path:

All reflective materials should be kept out of beam path.

- Specular surfaces must be removed from the beam path, if possible. If removal is not possible, the surfaces should be painted a flat black color or covered with a diffuse material. The intended target should be a diffuse, absorbing material to prevent reflections.
- Personnel must not wear watches or jewelry in controlled areas.

6: Protective housing with interlock present.

Any portion of the protective housing designed to be removed without tools shall be interlocked to prevent access to radiation in excess of the applicable class or to exposed energized circuitry.

- Protective housing interlocks must not be defeated or overridden unless the requirements of an LSO approved SOP are met.

7: Laser viewing optics:

All viewing optics (including lenses, telescopes, microscopes, and viewing windows) used in a laser experiment should be designed to protect the user from direct exposure to laser beams.

- Viewing optics shall not be used to view the direct beam or specular reflections unless an appropriate filter is used or adequate laser protective eyewear is worn to reduce laser radiation to safe levels.

8: Lab windows covered.

Laser labs windows and door viewing panels should be covered with laser absorbing material. No beam should ever escape out of a laser controlled area (LCA).

9: Laser protective barriers or curtains present.

Laser barriers or curtains used to prevent laser radiation exceeding the MPE from exiting the LCA must be appropriately rated. They must also be properly placed and in good condition.

10: Emergency stop/key or Master switch present.

A master switch present on a Class 3B or 4 laser or laser system. A master switch which will terminate the beam must be included on a Class 3B or 4 laser or laser system. It may be operated by a key or coded access. The key should be removable and the laser should be inoperable once the key has been removed.

11: Emission indicator system present & working (Class 3B, 4).

The emission indicator system is present and in working order. A visible and/or audible system must provide a visible or audible signal during radiation emission

12: Activation warning system present and working (Class 3B, 4).

A visible or audible warning device that activates prior to laser emission should be provided. The delay time should be sufficient to allow personnel to avoid exposure to the beam.

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B. Administrative and Procedural Controls

1: Laser safety training:

All persons operating a laser or laser system must complete and document the proper level of training. Training must be up-to-date and refreshed every 3 years. This training can be completed online by registering through your [EHS profile](#).

2: Laser Standard Operating Procedure (LSOP):

The laser or laser system SOP is up to date. The laser specific SOP must accurately reflect the current laser operations and characteristics. Changes to laser SOPs must be approved by the LSO prior to implementation. All the SOPs should be signed by all users in the lab.

- An LSO approved SOP must be in place for each Class 3R, 3B and 4 (including embedded) lasers or laser systems.

3: Laser beam alignment procedure present.

Laser beam alignment procedures are clearly outlined and accessible in the lab. When performing beam alignment for Class 3B and 4 lasers, the control measures outlined in the specific laser SOP must be followed.

4: Laser safety manual:

A copy of the laser safety manual should be available in laser labs.

5: Warning Labels:

All laser machines should have a visible warning label present indicating the class of laser and its power. Warning signs and labels shall be in accordance with the FDA Performance Standard and ANSI Standards.

6: LCA posted:

The Laser Control Area (LCA) is properly posted. For Class 3R, 3B and 4 lasers and laser systems, an appropriate warning sign must be posted at the LCA. The laser specific SOP will specify the posting requirements.

7: Door sign posted:

All doors that lead to the laser labs should have a door sign indicating type and power of the laser in accordance with the FDA Performance Standard and ANSI Standards. Additional precautionary instructions, such as eye protection required, must be included on the sign or label.

8: Laser safety guidelines posted.

Lab specific laser safety guidelines should be posted in all laser labs.

9: Emergency contact list posted:

Emergency contact information should be posted in the lab with all necessary numbers for emergencies. EHS will provide a template.

10: Fiber optics connector tag present:

A fiber optic connector which would allow access to Class 3B or 4 laser radiation must be tagged appropriately. For fiber optic laser systems where laser power termination is not possible, a label or tag bearing the words "Hazardous Laser Radiation When Disconnected" must be attached to the fiber optic connector.

C. Personnel Protective Equipment

1: Proper laser eye protection available & in good condition (Class 3R, 3B, and 4)

When required by the specific laser SOP, laser protective eyewear must be worn by laser operators and individuals present in the LCA. The eyewear may be required for routine use and/or beam alignment.

- Laser protective eyewear must be kept in good condition. *Examples of poor condition include loose or stretched straps, scratched lenses, unclear OD markings or inadequate frame integrity.*

2: The laser protective eyewear has correct Optical Density (OD) and is designed for the correct wavelength.

The laser specific SOP designates the proper OD protective eyewear which must be worn. The OD must be correct for the specific laser beam wavelength and be marked on the eyewear.

3: Protection against UV lasers available.

When required by the specific laser SOP, clothing (sleeves or gloves) or beam shields may be required to protect the skin from UV exposure. PPE should be available within the lab and provided by PI.

D. Non-Beam Hazards

- 1: **Electrical Hazard:** Electrical hazard control measures are properly implemented. Hazards associated with High Voltage Power and proper grounding of Optical tables are common hazards that are observed in a laser lab.
 - The laser specific SOP may list control measures for electrical hazards which must be implemented.
 - Electrical hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
- 2: **Collateral radiation hazard:** Collateral and/or plasma radiation hazard control measures are properly implemented.
 - The laser specific SOP may list control measures for collateral and/or plasma radiation hazards which must be implemented.
 - Collateral and/or plasma radiation hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
- 3: **Fire /Explosion hazard:** Fire and/or explosion hazard control measures are properly implemented.
 - The laser specific SOP may list control measures for fire and/or explosion hazards which must be implemented.
 - Fire and/or explosion hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
- 4: **Compressed gas hazard:** Compressed gas hazard control measures are properly implemented.
 - The laser specific SOP may list control measures for compressed gas hazards, which must be implemented.
 - Compressed gas hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
- 5: **Any additional SOP specific, non-beam hazard control measures are properly implemented.**
 - Laser dye and/or solvent hazard control measures are properly implemented.
 - The laser specific SOP may list control measures for laser dye and/or solvent hazards, which must be implemented.
 - Laser dye and/or solvent hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
 - Laser Generated Airborne Contaminant (LGAC): The laser specific SOP may list control measures for LGAC such as small particle, fumes, and/or nanoparticle hazards which must be implemented.
 - LGAC hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.
 - Cryogen control measures are properly implemented.
 - Cryogenics are used to cool down the atmosphere around a laser for specific studies. Steps of Cryogen safety should be included while writing SOP for laser.
 - Biological agent hazard control measures are properly implemented.
 - The laser specific SOP may list control measures for biological agent hazards, which must be implemented.
 - Biological agent hazards identified during the laser safety inspection must be addressed, and the appropriate control measures should be incorporated into the laser specific SOP.

E. Documentation

- 1: **All Class 3R, 3B, and 4 lasers registered with EHS.**

Each Class 3R, 3B, and 4 laser or laser system (including embedded lasers) must be registered with the LSO. The registration form can be accessed through the Environmental Health and Safety (EHS) [safety management system online](#).
- 2: **All SOP's and alignment procedures submitted to EHS.**

Each laser or laser system requiring a SOP (class 3B, 3R, and 4) must have a specific SOP which accurately documents the laser characteristics (i.e., class, power, control measures etc.). A template for this SOP is available at the bottom of the [EHS Laser Safety](#) page.
- 3: **Lab specific training documented**

Laser Standard Operating Procedure (SOP) Training Record is present at the time of inspection. This record must be located in the laser use area and be readily available for inspection. Laser safety training is mandatory for all users. This training can be completed online by registering through your [EHS profile](#).
- 4: **All documents required for audit are present**

Required Laser Safety Records are present for audit. All laser safety records must be organized and kept in a central location. These records include the Laser Standard Operating Procedure (LSOP) and the Laser Standard Operating Procedure Training Record and must be **kept in a clearly labeled binder or binders**. Maintained in a central location available for inspection.