UCF	Department of _____ Standard Operating Procedure for LASERS		
Laser Name/Class and Wavelength		**Laser Model and Serial Number**	
Laser Manager		**Building/Lab No.**	
Revision Number		**Date:**	
Revision made by		**Approved by PI:**	

1. **Circumstances of Use:**

This Standard Operating Procedure (SOP) outlines requirements to be considered by an authorized user of the XXXXnm laser as well as describes the normal operation of the laser and any hazards that may be encountered during normal operation. Finally, the SOP explains how to minimize any hazards and how to respond in an emergency. This document is to be reviewed one year from the date of approval or as conditions warrant, whichever is the shorter time period.

2. **Potential Hazards:**

A. Laser Hazards: The XXXXnm laser is a Class X laser. Severe eye damage (including blindness) and skin damage can result from direct beam and specular reflections. Eye damage can also result from diffuse reflections.
B. Electrical Hazards: electrical shock or electrocution could result from direct contact with high voltage. Be careful to make sure no liquids are on your gloves or hands when plugging laser power cords into power supply.
C. Chemical: Keep flammable solvents out of beam path.

3. **Work Practice Controls:**

A. Lasers

1) Only authorized personnel will operate lasers.
2) The laboratory doors will be closed, and the warning light will be turned on when the laser is operating.
3) During alignments, the laboratory doors will be closed, and the warning light will be turned on.
4) Unauthorized personnel will be only allowed entry to the laboratory during laser operation with the supervision of an authorized user under the terms specified by the PI.
5) Laser protective eyewear of OD X+ for working with the XXXXnm laser is available on the wall-mounted rack inside the lab, immediately to the right after entering.
6) Laser protective eyewear must always be worn when the laser is in operation.
7) No filters or other optics will provide suitable protection; use only laser safety protective eyewear with optical density necessary for the output power in use. *PLEASE NOTE:*

Laser protective eyewear is specific for the wavelength and power output and proper selection is important.

8) Specular and diffuse reflections will be controlled using apertures, beam housings, enclosures, and optics. All control methods must be in place during normal operation.
9) Laser alignment must be performed only by following the steps outlined in the alignment procedures in Section 5B.
10) Perform physical surveys to determine if there are stray beams (specular or diffuse emanating from each laser and its optics, and then document the beam surveys noting the location of stray beams and the measures taken to control them.
11) Methods of documentation of survey may be recorded.
12) If the beam path must be changed significantly by relocating the laser or optics, all users must be notified of the change.
13) The same precautions that are taken for safe operation of the laser must also be followed when adjusting any of the optics in use with the apparatus.
14) When a new principal researcher/experimenter takes over the use of the laser system, the new user must conduct a survey for unwanted stray or diffuse beams.

B. Electrical

1) Enclosures for protection against the high voltages of the laser power supply or laser head may only be removed after the power supply has been unplugged from the outlets and after following the safety procedures outlined in the safety and operations manual provided by the manufacturer.
2) Only qualified personnel may perform all internal maintenance to the laser and more than one user must be present when performing said maintenance.
3) Every portion of the electrical system, including the printed circuit cards, should be assumed to be at a dangerous voltage level.

C. Chemical

1) Always check that any flammable solvent placed under the laser beam does not ignite or combust by referencing the flash point of the chemical and the temperature increase of the chemical under laser exposure.

4. Personal protective equipment (PPE):

A. OD X+ laser protective eyewear specific to the wavelength and power of the laser.
B. Ultraviolet opaque clothing when working around high intensity UV lasers.
C. Long pants and closed toe shoes.

5. Experimental Procedure:

A. Normal Operation

1) Inspect all electrical and water connections for damage and connectivity.
2) Remove any jewelry or clothing that may reflect beams.
3) Obtain appropriate eyewear. Be certain it is of appropriate OD for the wavelength(s) in use.
4) Turn on the outside warning light
5) Close all doors and laser curtains/barriers.
6) Remove cover from optical setup.
7) Inspect optical setup for recent changes and/or foreign objects.
8) Verify that all engineering controls are in place and ensure that the laser path will be blocked.

9) Verify that all personnel in the lab are wearing the appropriate eyewear.
10) Issue verbal warning prior to starting laser.
11) Remove cap from laser.
12) Turn on laser power supply.
13) Insert key into laser controller.
14) Turn laser system on.

B. System Alignment

1) Inspect all electrical and water connections for damage and connectivity.
2) Use low-powered alignment laser, when possible.
3) Complete the Normal Operations checklist in Section 5A.
    a. The checklist serves to confirm that all basic systems are operating within expected parameters and that basic safety mechanisms are in place.
4) If a low-powered alignment laser is not available, adjust the beam power to the lowest possible power for alignment.
5) Adjust the laser to ensure that the beam is centered on the optic.
6) Using a viewing card or an electronic viewer, check for stray beams (including those behind the mirror), block these stray beams.
7) Continue these steps until all optics are properly aligned.
8) Check that all mounts are tightly in place and will not inadvertently shift, causing changes in alignment.
9) Only after completing these procedures should the laser be increased to desired power and repetition rate.
10) If more than one person is present, announce increase in power so that all people present are aware of the change.

Note:

a. Allow only trained personnel to be present during alignment. Minimize the number of personnel present during the alignment.
b. All people present must wear appropriate eyewear.
c. If possible, avoid using beam paths that are at sitting or standing eye level.
d. Where feasible, use low power (class 2 or 3A) visible lasers to simulate the path of high power or invisible lasers.
e. Where feasible, terminate laser beams and specular reflections on diffuse reflecting beam blocks.
f. Locate any specular reflections of the beam and block them as close to the source as possible.
g. Whenever possible, reduce all high-power laser beams to the minimum possible power.
h. Use beam shutters to block high power beams any time they are not actually needed.

C. System Shutdown

1) Shut down laser system.
2) Remove key from laser controller.
3) Turn off laser power supply.
4) Put cap on laser.
5) Place cover over optical setup.
6) Return eyewear to the wall-mounted rack by the lab entrance.

7) Turn off the outside warning light.

D. Emergency Procedures

1) Shut down the laser system.
2) Provide for the safety of personnel (first aid, evacuation, etc.). Seek medical assistance:
3) During normal business hours:
4) If you are an employee of UCF, contact UCF Health: 407-266-3627 and follow their instructions.
5) If you are a student, refer to Student Health Services: 407-823-2701 and follow their instructions.
6) After normal business hours: Contact **Care Now – Urgent Care,** 7460 University Blvd, Ste. 110 Winter Park, FL 3279, Phone: (407) 410-8945.
7) Inform your Principal Investigator of the accident as soon as possible. An Incident Report must be filed within one business day after the accident. Information on completing an Incident Report can be obtained at: https://ehs.ucf.edu/accident-investigation
8) Inform the UCF Laser Safety Officer of the accident as soon as possible: 407-823-0476 or Mario.DeVera@ucf.edu.

6. Waste Disposal:

Waste Policies & Programs

7. Exposures/Unintended contact:

Contact Environmental Health and Safety at (407) 823-6300 for medical advice on occupational chemical exposures. For an actual chemical exposure, complete the work-related injury or illness report found at: EH&S, Workplace Safety, Accident Investigation Form.

8. Spill Procedure:

Follow procedures outlined in Laboratory Safety Manual.

9. Training of personnel:

A. Authorized Personnel: The XXXXnm laser may be operated only by authorized personnel who are fully cognizant of all safety issues involved in the operation of such a device. These personnel are to ensure that the laser is only operated in the manner laid out in this document.

B. To become an authorized user, one must:

1) Successfully complete EHS 309 online laser safety training.
2) Unless required, obtain a baseline ophthalmologic examination (considered optional by ANSI Z136.1)
3) Read and fully understand the SOP
4) Receive training on the XXXXnm laser by an authorized user.
5) Sign and date the authorized user sheet to affirm that the above steps have been completed.

C. **Unauthorized personnel:** No unauthorized personnel may enter during laser operation unless accompanied by an authorized user. All visitors must be briefed on proper safety protocol and must wear appropriate laser protective eyewear located on the premises.

10. Documentation of Training *(Signature of all users is required)*

Training records must be in lab for SOP. Training record must state the SOP that the person was trained on and must contain the phrase "I have read and understand the content of this SOP", followed by the person's name, signature, and date of training.			
"I have read and understand the content of this SOP."			
Name	*Signature*	*Date of Laser Safety Orientation Training*	*Date of Lab Specific Laser SOP Training*