

# BGSU

**Bowling Green State University**



## **Laser Safety Program**

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# INTRODUCTION

## **Foreword**

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In 1970, the United States Congress established the right of workers to "safe and healthful working conditions" through the Occupational Safety and Health Act. This act created the Occupational Safety and Health Administration (OSHA). House Bill 308 incorporates by reference all federal OSHA standards found in the Code of Federal Regulations (CFR), Title 29 Parts 1910, 1926 and 1928 as Ohio Public Employment Risk Reduction Program (PERRP) standards. All Ohio PERRP standards are found in Chapter 4167 of the Ohio Revised Code and the Ohio Administrative Code.

This program has been established by Bowling Green State University to comply with OSHA-related standards, such as the General Duty Clause and the Personal Protective Equipment Standard (29 CFR 1910.132-.133), ANSI Z136.1 Standard for Safe Use of Lasers, as well as all other state and local regulations.

## **Objective**

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The objective of this program is to convey expectations on the safe use and personnel training related to lasers or laser systems and to ensure a safe working and community environment.

## **Applicability**

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This program applies to all university employees who use lasers or laser systems and to describe the procedures to be followed for the safe operation and use of such devices. These procedures apply to lasers of Class 2 or higher that are used for any purpose, whether for instruction, demonstration, entertainment, administration, processing, medical procedures, or research. The procedures apply to individuals who use lasers on this campus or in any facility operated by or under the auspices of BGSU. They also apply to persons from off campus who may be involved with the installation, calibration, repair, maintenance, or temporary use of such devices at BGSU or at an affiliated facility.

## **Responsibilities**

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Environmental Health and Safety (EHS) department, is responsible for:

- Coordinating, periodically evaluating, and updating the university's Laser Safety Program;
- Assisting departments and areas with implementation of the program; and
- Ensuring all affected employees receive proper training at required intervals.

Laboratory Directors/PIs/Supervisors are responsible for:

- Ensuring employees attend required training administered by the EHS department;
- Ensuring that all authorized personnel have completed an entry eye examination before starting laser work and have coordinated an exit eye examination prior to terminating laser work;
- Enforcing BGSU's Laser Safety Program by ensuring all employees under their direction comply with all facets of the program; and
- Providing a copy of the Laser Safety Program to employees upon request.

Laser Operators are responsible for:

- Completely adhering to all requirements set forth in this program; and
- Attending training sessions and performing entry and exit eye examinations as required.

### **Program Enforcement**

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A violation of a university employee's responsibility must be reported to the employee's immediate supervisor for appropriate action.

### **Accident Reporting**

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BGSU's electronic Injury/Illness form must be submitted if an operator has been involved in an accident or near-miss incident involving a laser. This form can be found on the Environmental Health and Safety (EHS) website.

## GUIDELINES FOR LASER SAFETY

### Laser Hazard Classification

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Lasers are divided by ANSI into four main classes according to the relative hazards associated with their use. These classifications are as follows:

- Class 1: Low power lasers or laser systems that are incapable of causing injury, even if the beam is viewed directly. Such lasers or laser systems do not require special precautions and are exempt from specifics of these guidelines. Class 1 lasers include laser pointers, laser copiers, laser scanners, and other similar equipment.
- Class 1M: Low power lasers incapable of causing injury except when viewed with optical aids such as an eye loupe or telescope. These lasers are exempt from any controls other than measures to prevent optically aided viewing.
- Class 2: Low power visible lasers producing output not exceeding 1 milliwatt. Injury can occur from extended direct viewing of the beams of such lasers, but protection normally is afforded by the natural aversion response of the eye (blinking). Procedural controls are not required for such lasers except for applications where intentional intrabeam exposure is intended.
- Class 2M: Low power visible lasers with output not exceeding 1 milliwatt. Protection is afforded by natural aversion response, but such lasers may be hazardous if the beam is viewed with optical aids. Procedural controls are necessary to prevent optically aided viewing.
- Class 3R: Lasers that produce visible or invisible radiation with an output power between 1 and 5 milliwatts. May be hazardous under certain direct and specular viewing conditions if the eye is focused and stable, but the probability for injury is small under normal operating conditions. Such lasers do not pose a diffuse reflection or fire hazard. Procedural controls not required except to prevent intrabeam exposure.
- Class 3B: Lasers that produce visible or invisible radiation with an output power from 5 to 500 milliwatts. Such lasers are considered medium power and can produce eye injury when viewed even momentarily with the unaided eye. Class 3B lasers usually do not produce a hazardous diffuse reflection or fire hazard, but skin burns are possible at the upper end of this power range. Procedural and administrative controls are required for such lasers as well as operator training. Medical eye surveillance is also recommended for persons working regularly with such lasers.
- Class 4: Lasers emitting either visible or invisible radiation with power greater than 0.5 Watts. Such lasers can cause injury to the eye or skin even from momentary viewing of the direct beam or from specular or diffuse reflection. Class 4 lasers also can produce fire hazard.
- Class 1 lasers generally are considered non-hazardous and do not require special precautions in their use. Such lasers fall outside the purview of these guidelines.
- Class 1M lasers are non-hazardous except when the beam is viewed with optical aids. Such lasers are exempt from control measures other than those to prevent optically aided viewing.
- Class 2 lasers also are non-hazardous under normal operating conditions, but injury can be sustained with improper use. For instance, forced or intentional long term direct viewing of the laser beam for a

Class 2 laser can result in eye injury. Operators of these systems need instruction in proper use and handling, but no special precautions are needed for the rooms where such lasers are used.

- Class 2M lasers are generally safe but can cause injury if collecting optics are used. For these reasons, special instruction in the care and handling of such instruments is needed as well as security to ensure that items such as binoculars or microscopes are not able to be used accidentally with such lasers.
- Class 3R lasers are potentially hazardous under certain viewing conditions, but the probability of injury is small under normal operation. Procedural controls are not required for such lasers except those to prevent intrabeam viewing.
- Class 3B lasers can produce injury if viewed directly, and injuries also are possible by specular reflection. But these lasers usually do not produce hazardous diffuse reflections or fire hazards. Special eyewear may be needed for operators of such lasers and attention should be given to the environment where such lasers are operated. For example, partitions or beam stops may need to be installed, and items that could cause specular reflection removed.
- Class 4 lasers can cause injury to the eye or skin and can produce dangerous specular and diffuse reflections. They also can produce fire hazards. Such lasers clearly require the most serious attention to safety precautions.

Safety procedures depend not only on the class of laser but also on the use to which the laser is put. For example, a Class 3B open beam laser that emits invisible radiation and that is used in an unsupervised research or instructional environment by different individuals who may have received no or only minimal training, can be more dangerous than a Class 4 laser with a visible beam that is contained within an enclosure and used, say, for routine processing work in the hands of a single experienced operator. Accordingly, the levels of control vary with the situation and each case must be examined separately. The Laser Safety Officer will work in conjunction with laboratory directors and/or supervisors to assess the hazard levels associated with a laser installation and will recommend specific safety procedures for implementation in that situation.

The Table below lists some typical lasers found at BGSU and their classifications.

Laser Type	Wavelength (nm)	Power (Watts)	Class
He-Ne	633	.001	2
Argon	488, 514	.001	2
InGaAlP (diode)	670	.001	2
Argon	488, 514	.001 to .005	3R
He-Ne	633	.001 to .005	3R
He – Ne	633	.01 to .05	3B
Argon	488, 514	<0.5	3B
Nd:YAG	1064	<0.5	3B
Nd:YaG	1064,532,355,266	>0.5	4
Argon	514,488	>0.5	4
Ti:Sapphire	780	>0.5	4
Dye	400 to 550	>0.5	4

## Acquisition and Registration of Lasers

Any laser of Class 3B or higher laser that is to be used at BGSU must be registered with the Department of Environmental Health & Safety (EH&S). This policy applies whether the instrument is purchased, loaned, obtained through donation, or acquired through other means. EH&S will coordinate the acquisition and registration of all such devices. Before submitting a requisition for purchase of such a device to the Purchasing Department, the request first should be submitted to EH&S accompanied by a written statement that sets forth the basic features of the laser device and its intended use. EH&S will record information needed for institutional records and forward approved requisitions to Purchasing. The director of the laboratory or facility where the laser is to be used is responsible for filing a work plan with the Laser Safety Officer (see below) and for developing a suitable set of instructions or operating procedures for the laser and its intended use prior to installing and using the device. For Standard Operating Procedures and Inventory Forms that will most likely be requested prior to purchase by the LSO, please refer to *Appendix B* and *Appendix E*.

### **Laser Safety Officer (LSO)**

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ANSI standards require that a Laser Safety Officer (LSO) be designated by the administration of any educational institution where faculty, staff, or students are involved with the operation of Class 3B or Class 4 lasers. At BGSU, the LSO is designated by the Vice President for Finance and Administration and is a member of the Department of Environmental Health and Safety. The role of the LSO is to administer and manage the overall laser safety program for the institution and to monitor and enforce procedures necessary to minimize laser hazards on campus. The LSO also is responsible for insuring that personnel involved with the use of lasers on campus are properly instructed or trained. Primary responsibilities of the LSO include, but are not limited to, the following:

- Classify or verify the classification of all lasers on campus consistent with the standards outlined in ANSI Z136.1-2014.
- Monitor the purchase or acquisition of lasers and maintain a registry of these instruments together with the names of principal users and a description of the intended uses to be made of the respective instruments.
- Evaluate the hazards of laser work areas and laboratories including:
  - Establishment of Nominal Hazard Zones (NHZ's) as prescribed in ANSI Z136.1-2014
  - Evaluation and approval of Standard Operating Procedures (SOPs) for each laser lab
- Inspect teaching and research set-ups involving lasers
- Identify potential hazardous conditions and notify appropriate authorities
- Discontinue, cancel, or postpone any project until safety conditions are addressed
- Insure that prescribed controls and procedures are in effect
- Recommend or approve personal protective equipment (PPE) and related safety items –
  - e.g. eyewear, barriers, screens, clothing, signs, interlocks, etc.



- Perform periodic audits of PPE, safety procedures, facilities and equipment
  - Approve wording and format of signs and labels displayed in the labs
  - Approve laser installations and equipment prior to initial use or following any physical move or modification of facilities or equipment
  - Ensure adequate training of personnel who work or teach in laser labs
  - Maintain records of training for persons who work with lasers
  - Identify personnel who require medical surveillance and ensure that applicable eye exams are scheduled and performed. Maintain records of same.
  - Investigate accidents involving lasers, make reports, notify appropriate agencies, keep records of such incidents, and institute remedies to any identified problems in safety procedures
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### **Laser Safety Committee**

In addition to the LSO, a Laser Safety Committee (LSC) assists with oversight of the laser safety program and helps to ensure that faculty, staff, and students are provided with needed information and understand the hazards associated with lasers or laser systems with which they might work. Membership on this committee includes five representatives selected from the faculty, staff, and student body at BGSU, as follows:

- Laser Safety Officer (ex-officio member and executive secretary for the committee)
- Classified or Contract Staff Representative (appointed by the Laser Safety Officer)
- Faculty members from use departments (two members from different departments; individuals appointed by the department chairs to serve alternate two-year terms)
- Student Representative (one graduate student from a department that uses lasers; department representation to be alternated each year)

The Laser Safety Committee is responsible for establishing and reviewing policies and procedures adequate for the control of laser hazards and for recommending appropriate safety instructions and/or training for faculty, staff, and students. General institutional policies that are recommended and approved by the LSC are incorporated in this program declaration. Safety practices and procedures that are recommended and approved for implementation within a specific laboratory or for a laser system are included in a written set of Standard Operating Procedures (SOP) for that laboratory or system. Such SOPs are required for any laboratory or facility that employs a Class 3B or Class 4 laser or laser system. The Laser Safety Officer, in consultation with the Laser Safety Committee, is responsible for reviewing and approving all SOPs for compliance with safety requirements outlined in the ANSI standards and/or with other requirements that may be called for in institutional, state, or federal guidelines. The LSO also is responsible for reviewing and reporting on incidents that occur in facilities where lasers are used and, in cooperation with the LSC and facility directors, for making recommendations for remedy to prevent future occurrence of such incidents.

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## **Responsibilities of Laboratory Directors and Principle Investigators (PIs)**

Faculty members and other BGSU employees who oversee the use or maintenance of a laser or laser system that are Class 2 or higher will ensure the purchase of newly requested lasers abide by the guidance of Purchasing Department procedures and will fill out a Laser Inventory form that must be sent to the LSO (*see Appendix E*). This form will become part of a permanent institutional registry and contains information about the manufacturer, power, wavelength, date of acquisition, and location of the laser as well as a brief description of its intended use. These registries will be reviewed by the LSO and the information will be used to evaluate the hazard levels of the laser system and to make recommendations for safety equipment and procedures to be followed by users of the instrument. The Laser Safety Committee may also assist in the evaluation of new laser systems or following the request to move a laser system.

Each director of a research or teaching laboratory where lasers are to be employed is responsible for attending laser safety training offered by the LSO and for seeing that other individuals who use lasers in his or her laboratory attend such training. Directors of research and teaching laboratories are responsible for developing and implementing a set of Standard Operating Procedures (SOP) for that lab. These SOPs should include basic instructions on safe operation and use of the laser or laser system, including the use of appropriate eyewear and other personal protective equipment, and emergency instructions. Each SOP should be developed specifically for the laboratory or facility where it is intended to be employed, and each SOP is to be reviewed by the LSO prior to its implementation. A SOP template can be found in Appendix B.

Laboratory directors are responsible for installing any necessary safety devices and for implementing any necessary safety procedures that may be called for in their SOP. For instance, the use of room partitions, safety curtains, beam stops, special eyewear, or other personal protective equipment may be required prior to operation of a given system. The laboratory director is responsible for obtaining these items and insuring their use. Certain restrictions of access or special lockout/tagout procedures also may be necessary. In general, the lab director and the LSO are jointly responsible for insuring that appropriate procedures are put in place for a given lab, that the needed safety equipment has been secured, and that the personnel working there have been properly trained.

Laboratory directors shall report information to the LSO when a laser or laser system is transported to a different location. This will help the LSO keep a running inventory of the location of laser and laser systems throughout Bowling Green State University.

Laboratory directors will immediately report any exposure incident involving lasers to the LSO using the University's standard injury and illness report form.

## **Authorized Laser Operators**

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Persons who operate Class 3B or 4 lasers or laser systems must be authorized by the LSO. Authorization requires demonstration of sufficient knowledge of the laser device and satisfactory completion of basic laser safety training. Operators of Class 3B and 4 lasers must also undergo a baseline eye examination prior to assignment to laser duties. In the event of an accidental or suspected eye exposure to laser radiation, a thorough eye examination will be conducted.

SOPs and laser operator authorization are specific to each laser device. To be authorized as an operator, an individual must complete basic laser training offered by the LSO and satisfactorily demonstrate knowledge of laser fundamentals, basic laser safety principles, and an understanding of the specifics of the SOP that has been designed for the laser in question.

Authorized laser operators will immediately report any exposure incident involving lasers to the LSO using the University's standard injury and illness report form.

## TRAINING

### **Instruction and Training**

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In conjunction with recommendations of the LSC, and in compliance with regulations specified in ANSI Z136.1, the LSO in cooperation with each facility director will seek to ensure that all individuals using Class 3 or 4 lasers receive written instructions in the safe operation and use of such lasers. Individuals who use or operate Class 3B or 4 lasers must complete a medical eye examination prior to employment and a comprehensive training program that, at minimum, includes the following topics:

- Fundamentals of laser operation (physical principles, construction, etc.)
  - Biological effects of laser radiation on the eye and skin
  - Significance of specular and diffuse reflections
  - Non-beam hazards of lasers
  - Laser and laser system classification
  - Control Measures
  - Overall responsibilities of management and employee
  - Medical surveillance practices (if applicable)
  - Signs and labels for rooms where lasers are located
  - Emergency procedures in case of an accident
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### **In-Class and Online Training**

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In-class training is most often coordinated at the beginning of fall semester during graduate student orientation. Requests for special in-class training can be directed to the LSO in advance of the desired training date. Otherwise, online training is available in Bridge via your MyBGSU account. The online training covers the same topics as the in-class training. Prior to attending a laser safety training course, all attendees must have already scheduled or have completed Laboratory Safety and Health training, or refresher training if not up to date.

### **Eye Examinations**

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Following the successful completion of either the in-class or online training, laser operator candidates are required to notify the LSO to receive further information on how to schedule their entry eye examination. This eye examination is fully funded by Environmental Health and Safety. The eye examination covers these main points:

- A test of visual acuity using the standard Snellen eye chart;
  - A test for retinal health using the Amsler grid;
  - A visual field analysis to test for peripheral vision; and
  - A digital image of the retina that will be kept on file with the optometrist.
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Prior to discontinuing laser work at BGSU, the authorized laser operator is required to contact the LSO for an exit eye examination.

## **Re-Training**

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Refresher training in relevant topics is required when any of the following occur:

- 365 days have lapsed since the completion of the initial completion of the laser safety training;
- An operator has been observed to operate lasers in an unsafe manner;
- A request for re-training has been submitted to the LSO by a PI; or
- Changes occur to the Laser Safety Program.

## **APPENDIX A: GLOSSARY**

## Glossary

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**ANSI** – American National Standards Institute: An institution devoted to the development and dissemination of operating standards that have been developed through a consensus of users and that can be used as a guide for manufacturers, consumers and the public for the safe operation and use of lasers and laser systems.

**LASER** – Acronym for light amplification by the stimulated emission of radiation. Refers to a device that typically emits radiation in the ultraviolet, visible, or infrared regions of the electromagnetic spectrum, specifically in the wavelength range from 180 nanometers to 1 millimeter.

**LSC** – Laser Safety Committee: A five-person committee consisting of faculty, administrative staff, and student representatives charged with overseeing the laser safety program at BGSU and with making recommendations and reviewing policies or procedures for the purpose of protecting the health and safety of persons who work with or around lasers at BGSU.

**LSO** – Laser Safety Officer: A staff member of the department of environmental health and safety who is designated to oversee the laser safety program for BGSU.

**MPE** – Maximum Permissible Exposure: The level of laser radiation to which a person may be exposed without hazardous effects or adverse biological changes in the eye or skin.

**NHZ** – Nominal Hazard Zone: The space within which the level of direct, reflected, or scattered radiation during normal operations exceeds the applicable Maximum Permissible Exposure (MPE). Exposure levels beyond the boundary of the NHZ are below applicable MPE limits.

**PPE** – Personal Protective Equipment: Items such as gloves, lab coats, or eyewear that may help to reduce personal exposure to laboratory hazards. In the case of some lasers, special eyewear is designed to block or attenuate specific wavelengths of radiation to levels below those that would be harmful to the wearer.

**SOP** – Standard Operating Procedures: A set of practical guidelines for safe operating procedures to be followed within the context of a specific laboratory or work environment where lasers are used. SOPs are developed by the laboratory or facility director and reviewed and approved by the LSO and LSC.

**APPENDIX B: STANDARD OPERATING PROCEDURE  
FOR LASERS**



**Standard Operating Procedure for: Class 3B/4 Laser or Laser System Use**

Principal Investigator(PI): \_\_\_\_\_ Other Contacts: \_\_\_\_\_

PI Office Location: \_\_\_\_\_ Building/Room Number: \_\_\_\_\_

Telephone Number: \_\_\_\_\_ E-mail: \_\_\_\_\_

For applications working with Class 3B/4 lasers or laser systems, all personnel managing or using the device must be trained on BGSU's Laser Safety Program, including required entry and exit eye examinations. Any questions should be transferred to the managing Department and/or the Laser Safety Officer within the Department of Environmental Health and Safety.

**Laser Information:**

Laser Type:

Laser Class:

Manufacturer:

Date acquired:

Maximum output power (W) or maximum energy (J):

Operational Wavelength (nm):

Pulsed or Continuous Wave:

Beam diameter (nm):

If pulsed, specify the frequency and whether single or repetitively pulsed:

**Hazards associated with this laser** (*check all that apply*):

Eye:

Skin:

Electrical:

Air contaminants:

Other (please describe):

**Control Measures**

For each hazard listed above, briefly state the control measures to be used to mitigate injury.

Entryway Controls (please describe):

**Personal Protective Equipment required:**

Specify the type of eyewear and/or skin protection to be used.

**Hazard evaluation(s):**

Has the nominal hazard zone for this laser been determined? If so, has this area been demarcated and are appropriate barriers in place? Explain with a brief sketch or description.

Briefly describe the procedure used to determine the nominal hazard zone for this laser.

*Note: A hazard evaluation is required by ANSI for Class 3B and 4 lasers. This document should be attached or kept on file with your SOP.*

Describe any other physical or mechanical controls utilized to minimize hazards – e.g. beam stops, barriers, automatic shut down, etc.

**Alignment Procedures for this laser** (list here or attach):

**De-energizing Procedures** (to be used when working on exposed electrical parts):

**Training Requirements** (specify training required of users for this laser):

**Emergency Procedures** (List actions to be taken in case of emergency, including personnel to be contacted):

**Approved Operators** (List all individuals authorized to operate this laser without supervision):

## **APPENDIX C: LASER LABORATORY CHECKLIST**

PI: \_\_\_\_\_

**Laser Laboratory Inspection  
Check Sheet**

Date: \_\_\_\_\_

**A. Postings and Labeling**

1. Appropriate signs (e.g. Class 3B or 4) in place, conveying information about wavelength any required eye protection
2. Emergency contact numbers posted conspicuously
3. Laser listed on hazards communications poster

**B. Physical Aspects**

1. Is beam appropriately enclosed or blocked?
2. Are all beam paths out of eye level?
3. Has a nominal hazard zone been identified?
4. Are provisions in place to reduce stray reflections?
5. Is there a safety interlock system and log of when it is checked?

**C. Protective eyewear**

1. Is appropriate eyewear available and easily accessible?
2. Is the optical density (OD) clearly marked on eyewear?
3. Is intrabeam or direct viewing of laser beam prevented?

**D. Procedures**

1. Are written protocols available for workers?
2. Have all personnel received laser safety training?
3. Have personnel completed medical eye exams
4. Do written procedures exist for beam alignment?
5. Is remote viewing available for invisible beams?

**APPENDIX D: LASER CUTTER SAFETY AND STANDARD OPERATING  
PROCEDURE FORM**

Laser Cutters are devices that use high-energy lasers to accurately cut and engrave material. Although laser cutters are considered Class 1 systems due to it being enclosed, non-beam hazards, such as electrocution, fire, or chemical exposure, can occur. This requires special awareness, administrative controls, and proactive measures to ensure property and personnel safety.

Prior to purchasing or installing a unit, the Laser Safety Officer, from Department of Environmental Health and Safety, must be contacted to perform an initial hazard analysis of the proposed laser cutter and working space. The following checklist should be followed in areas that use laser cutters. In addition to this checklist, Standard Operating Procedures (SOPs), are to be created and stored near the area of operation. This information is also required to be shared with users of the laser cutter.



## Laser Cutters

DO	DO NOT
Follow BGSU Fire Safety Guidelines. These can be found on the Environmental Health and Safety (EHS) webpage under “Fire Safety”.	Perform in-house component testing, replacement, or equipment modifications to the laser cutter.
Have access to an approved fire extinguisher within the immediate work area.	Perform laser cutting without a written Standard Operating Procedure (SOP). Contact EHS/Laser Safety Officer for help, if needed.
Clean table, enclosure, top door and beam window, mirrors, and lens per manufacturer’s recommendations.	Leave a laser cutter unattended when it is actively in use.
Check for loose parts, maladjusted belts, or other abnormalities prior to use.	Use laser cutter on material not approved by the manufacturer or the instrument owner.
Clean bearings, tracks, fan filter, and belt per manufacturer’s recommendations.	Use extension cords to power a laser cutter. All laser cutters should be plugged into a proper electrical outlet based on manufacturer’s recommendations.
Lubricate lead screws routinely, per manufacturer’s recommendations.	Allow untrained or unauthorized personnel to use the laser cutter unless accompanied by a trained or authorized person.
Clean exhaust and duct, which is attached to the unit, at least once a year.	
Turn off laser cutter if flare-ups occur by hitting the Emergency Stop, or by following manufacturer’s recommendations.	

## Ductwork, Filters, and Ventilation

DO	DO NOT
Periodic inspections to the filtration, ventilation, and/or ductwork system to ensure it is working properly.	Perform in-house component testing, replacement, or equipment medication to any filtration or ventilation system, outside of cleaning the unit and filter replacement.
Clean duct, cooling inlets, and outlets at least once a year.	Operate laser cutter or ventilation unit if error codes are present on the control panel.
Replace filter in accordance with the manufacturer's recommendation (i.e. 75% blockage for BOFA charcoal filters).	Change filters without consulting the manufacturer's safety manual to ensure proper personal protective equipment (PPE) and procedures are followed.
Consult Campus Operations and EHS before installing a new filtration or ventilation system or making modifications to an existing system.	

## Laser Cutter Standard Operating Procedures

Due to the physical and chemical hazards associated with the use of laser cutters, a written Standard Operating Procedure (SOP) must be written and tailored to the work conducted on the machine. Maintenance schedules are also required to be noted. The minimum frequency maintenance tasks should be conducted is what is recommended by the manufacturer, as noted in the manual for the laser cutter or filtration/ventilation system. An example of the Laser Cutter SOP is shown below, however an editable document can be found on the EHS webpage under "Radiation and Laser Safety".



**Standard Operating Procedure for: Laser Cutter Use and Maintenance**

Contact(s): \_\_\_\_\_ Building: \_\_\_\_\_

For applications working with laser cutters, all personnel managing or using the device must be trained on BGSU’s Laser Safety Procedures on Laser Cutting. Any questions should be transferred to the managing Department and/or the Laser Safety Officer within the Department of Environmental Health and Safety.

**Designated Area for Work:**

- All laser cutter use and maintenance work shall be done

**Process to conduct work:**

**Personal Protective Equipment required:**

**Special Handling Procedures and Approved Cutting Materials:**

**Maintenance Schedule:**

**Laser Cutter:**

<b>Task</b>	<b>Frequency</b>	<b>Responsible Party (Department/Service Personnel)</b>
Clean table, enclosure, top door and beam window, mirrors, and lens.	<i>{Refer to Manufacturer’s Manual}</i>	
Check for loose parts, maladjusted belts, or other abnormalities.	Prior to each use.	
Clean bearings, tracks, fan filter, and belt.	<i>{Refer to Manufacturer’s Manual}</i>	
Lubricate lead screws.	<i>{Refer to Manufacturer’s Manual}</i>	
Clean exhaust and duct.	Annually	

**Ductwork, Filters, and Ventilation:**

<b>Task</b>	<b>Frequency</b>	<b>Responsible Party (Department/Service Personnel)</b>
Visual inspections of ductwork, filtration, and ventilation systems.	Periodic	
Clean duct, cooling inlets/outlets	Annually	
Replace filter (if applicable)	<i>{Refer to Manufacturer's Manual}</i>	

**Accident Procedures**

- In the event of an accident or emergency, immediately vacate and secure the area. Contact BGSU Police (911) and Environmental Health and Safety at 419-372-2171.

## **APPENDIX E: LASER INVENTORY FORM**

**LASER INVENTORY FORM**

Date

Department

PI Office & Phone Number

Principle Investigator (PI)

Building

Room Number

Please complete for each laser present in the room that is class 3B or 4.

Laser Manufacturer	Laser Model	Laser Serial Number
Laser Medium	Manufacturer Hazard Class	CW or Pulsed (if P; freq & length)
SOP completed	Eye Protection Available	Owners Manual Present

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Has the laser been modified and changed the hazard class?

Laser Manufacturer	Laser Model	Laser Serial Number
Laser Medium	Manufacturer Hazard Class	CW or Pulsed (if P; freq & length)
SOP completed	Eye Protection Available	Owners Manual Present

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

Maximum Power/Energy: \_\_\_\_\_ mW/mJ

Wavelength(s): \_\_\_\_\_  $\mu\text{m}$

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Has the laser been modified and changed the hazard class?