



Veterinary Medical Laser Safety Guideline

Purpose and Scope

The UW – Madison (UW) laser safety program guidelines are established to reduce the risk of injury to animal patients and veterinary staff. Veterinary Medical Laser guidelines is based on guidance from ANSI Z136.1 Standard “The Safe Use of Lasers” and ANSI Z136.3 for “Safe Use of Lasers in Health Care Facilities”.

The purpose of the program is to provide maximum safety to animal patients and veterinary care personnel during procedures that involve the use of a healthcare laser system (HCLS) in the UW Veterinary Medicine facilities.

To establish safety measures for working with Class 3B and Class 4 lasers and laser systems in the research and instructional laboratories. The laser safety program ensures:

- The use of equipment which produces laser radiation is used in a manner that will minimize risks to health and safety of the faculty, staff, students, patients, and the public
- The identification of laser hazards
- Prompt investigation of all reported laser radiation over-exposures and the establishment of immediate corrective action(s) to prevent their recurrence
- The maintenance of accurate inventory of the hazardous lasers within UW-Madison Vet Med

Laser Safety Program Roles and Responsibilities

The Office of Radiation Safety (ORS): The ORS, within the Environment Health & Safety (EH&S) department at UW, manages the research and medical laser safety programs under the oversight of the Research Laser Safety Committee (RLSC) or Medical Laser Safety Committee (MLSC). A separate safety plan covers research lasers given the disparate requirements between a laser used for research and a laser used in a medical setting.

Medical Laser Safety Committee (MLSC): MLSC is responsible for the oversight of medical lasers at UW Health facilities and veterinary clinic. MLSC duties and responsibilities:

- Laser trends
- Hazard monitoring
- Develops, reviews, and revises policies and procedures, as necessary.
- Establishes requirements based upon applicable regulations, guidance, and best practices.
- Resolves conflicts or issues identified by the LSO, laser users or other parties.

Research Laser Safety Committee (RLSC): RLSC is responsible for the oversight of the laser and laser systems used on the UW-Madison campus. RLSC duties and responsibilities:

- Develops, reviews, and revises policies and procedures, as necessary.

- Establishes requirements based upon applicable regulations and guidance.
- Resolves conflicts or issues identified by the LSO, laser users or other parties.

Laser Safety Officer (LSO)

The LSO reports to the Radiation Safety Officer (RSO). LSO duties and responsibilities (per ANSI Z136.1-2014):

- Administer the day-to-day operation of the Laser Safety Program.
- Maintain a current inventory of Class 3B and 4 lasers.
- Perform laser hazard analyses and audits; ensure, by follow up and additional audits as necessary, that all laser safety deficiencies are addressed and resolved.
- Make recommendations to improve laser safety.
- Restrict or terminate use of lasers that present an imminent danger or excessive hazard.
- Ensure the availability of proper laser safety training.
- Verify protective equipment and devices are available and make recommendations for selection of proper personnel protective equipment.
- Investigate laser accidents and near misses.
- Update laser safety policy and procedures as needed.
- Review, approve, and maintain a copy on file of all lasers standard operating procedures (SOPs).
- Review laser user's laser safety training records until that user is no longer involved with laser use at UW.
- Provide reports on the status of laser safety to the RLSC, MLSC and RSO, and promptly inform the RSO of any serious laser safety concerns.

Managers and Healthcare Personnel

Departments that use HCLS shall comply with all aspects of this plan and assist with periodic monitoring of the safe use of HCLS. When observations are made that might suggest unsafe practices, the manager and Laser Safety Officer involved with assessing risk and employing safe practices should be informed.

Laser User

A person responsible for setting up the laser prior to use or who operates the console to control the laser parameters under supervision of the user. This is the person who handles the laser equipment and in general controls the application of the laser radiation at the working area.

The laser user should have no competing responsibilities that require leaving the laser unattended during active use and should be assigned for every procedure, except when the laser console is controlled by the laser user.

Responsibilities include, but are not limited to:

- Posting appropriate warning signs on all OR doors where laser is in use.
- Providing appropriate personnel protective equipment for patient and staff and monitor their user during the laser procedure.
- Calibration and test firing of the laser pre-operatively, when required.
- Monitoring adherence to all laser safety policies, procedures, guidelines established by the UW-Health and Medical Laser Safety Committee,
- Completion of the laser safety checklist
- Immediate reporting of any laser incidents to Supervisor and ORS Laser Safety Officer. Medical Laser Safety Committee will review all incidents involving laser.

Laser Operator

A qualified person who controls the application of the laser radiation at the working area and is applying the laser energy of the HCLS for its intended purpose within their scope of practice, license, training, and experience.

The person operating the laser always has the primary responsibility for all hazards associated with laser use. ANSI Z136.1 Section 3.5.2

- Monitoring adherence to all laser safety policies, procedures, guidelines established by the UW-Health and Medical Laser Safety Committee,
- Immediate reporting of any laser incidents to Supervisor and ORS Laser Safety Officer. Medical Laser Safety Committee will review all incidents involving laser.

Personnel Servicing Laser Systems

Service personnel shall be qualified to perform work on HCLS and conduct routine maintenance on all HCLS within a managed facility in accordance with manufacturer recommendations.

Laser Registration

It is the responsibility of the Permit Holder (PH) to register all Class 3B and Class 4 Lasers under his/her authorization with ORS. Class 1, Class 2 and Class 3R lasers or laser systems are not required to be registered.

[Research Laser Registration Form](#)

[Medical Laser Registration Form](#)

[Commercial Embedded Laser Device Registration Form](#)

Training and Qualifications

The laser safety training is mandatory for all users of medical lasers as well as those who could be potentially exposed. Users are defined as persons that use the lasers (operators, technicians, students, physicians, veterinarians).

All personnel (including contracted personnel) who operate the laser must be educated in detailed training on laser safety and laser physics with return (hands on) demonstration. All training will be documented and kept on file by the department. Refresher training is mandatory and may include but is not limited to following topics:

- Laser safety program and policies, changes, reminders
- Updates on the regulations and standards
- Laser and laser system classifications, warning signs, and labels
- Protective eyewear and optical density
- Lessons learned from actual laser incidents.

Training for any person who will be conducting maintenance, repairs, alignment and/ or otherwise provide service to laser or laser systems shall have the training that is commensurate with the class of the laser or laser system contained within the protective housing (ANSI Z136.1). Laser user's shall take the RS 110: Medical Laser Refresher Training with training interval not to exceed 40 months.

Table 1: Laser Safety Training for Operators and Others (Based on Hazard Classification of Laser)

Type of instruction	Laser Class						
	1	1M	2	2 M	3R	3B	4
Manufacturers Operational Manual	X	X	X	X	.	Y	Y
RS 107: Laser Safety (DOE)	X	X	X	X	.	Y	Y
RS 108: Laser Safety Refresher	X	X	X	X	.	Y	Y
RS 109: Medical Laser Safety (Veterinary Medicine)	X	X	X	X	.	Y	Y

RS 110: Medical Laser Refresher Training	X	X	X	X	.	Y	Y
PH Laboratory – Specific training	X	X	X	X	.	Y	Y

Y - Required
 . - Recommended
 X - Not Required

Medical Surveillance

A baseline eye exam is required before use of Class 3B and Class 4 health care laser systems. Occupational Medicine at UW-Madison provides baseline eye examinations. Occupational Medicine is located at 333 East Campus Mall, floors 5-8.

Please see the [ORS website](#) for more information on Medical Clearance instructions.

Eye examinations are required for laser workers in the event of any accidental or suspected eye exposure to laser radiation.

Hazard Evaluation and Classification

Various aspects of the HCLS influence the total hazard evaluation, and thereby affect selection of the control measures to be applied:

- The capability of the radiant energy of the HCLS to injure HCP or the intended patient.
- The environment in which the HCLS is used.
- The HCP who may use or be exposed to laser radiation.
- The delivery system which is important to defining the extent of the NHZ.
- The non-beam hazards associated with the HCLS.

The FDA requires that all HCLSs be classified by their manufacturers in accordance with the Federal Laser Products Performance Standard.

Program Evaluation and Inspections

All areas used for laser treatment are to be inspected by the Medical Laser Safety Officer or their designate. The MLSO should be present during visits of regulatory agencies for laser equipment inspections. A laser safety audit of the facility that focuses on personnel, patient safety features (e.g. eyewear, barriers, area controls, plume removal and warning signs) and equipment safety features (interlocks, labels, etc.) should be conducted and documented under the supervision of the MLSO. Additionally, efforts will be made by MLSO and Safety Department to assess laser use throughout UW Madison to ensure all potential laser users are enrolled into the Medical Laser Safety Plan and baseline eye exam offered by Employee Health Services. Once this plan is in effect, the MLSO is responsible for coordinating an initial audit for assessment. Thereafter, an audit should be performed annually. The audit should include a way for laser users, physicians, veterinarians, nurses, and operating room personnel to notify the MLSO of problems with the controls such as lack of SOP's, damaged eyewear, foot pedal issues or incorrect signage. The results of periodic audits and annual program evaluation will be shared with the UW Madison Laser Safety Committee for review and feedback.

Health Care Laser System (HCLS) Classification

The HCLS classification scheme is based upon aspect – the capability of the radiant energy of the HCLS to injure Health Care Professionals (HCP) or the intended patient.

Class 1

Any laser or laser system containing a laser that cannot emit laser radiation at levels that are known to cause eye or skin injury during normal operation. This does not apply to service periods requiring access to Class 1 enclosures containing higher class lasers.

Class 1M

Considered to be incapable of producing hazardous exposure conditions during normal operation unless the beam is viewed with collecting optics and is exempt from any control measures other than to prevent potentially hazardous optically aided viewing.

Class 1C

Laser radiation is intended to be applied in contact with the intended target and has safeguards that prevent leakage of laser radiation in excess of the accessible emission limits (AEL) of Class 1.

Class 2

Low power emits in the visible portion of the spectrum (400 nm to 700 nm) and eye protection is normally afforded by the aversion response.

Class 2M

Emits in the visible portion of the spectrum (400 nm to 700 nm) and eye protection is normally afforded by the aversion response for unaided viewing. However, Class 2M is potentially hazardous if viewed with collecting optics.

Class 3R

Has reduced control requirements and is potentially hazardous under some direct and specular reflection viewing conditions if the eye is appropriately focused and stable, but the probability of an actual injury is small.

Class 3B

May be hazardous under direct and specular reflection viewing conditions, but is normally not a fire hazard, diffuse reflection hazard, nor a laser generated air contaminant (LGAC) production hazard.

Class 4

Is a hazard to the eye or skin from the direct beam, may pose a fire hazard or diffuse reflection hazard, and may also produce LGAC and hazardous plasma radiation. Most surgical lasers and all lasers emitting in excess of 0.5 W average radiant power are classified as class 4.

Laser Hazard Control Measures

Control measures are established in the Z136.1 standard as a means of reducing the possibility of skin and eye exposure to laser radiation, during normal operation and maintenance, above their respective maximum permissible exposure (MPE). MPE is the level of laser radiation to which an unprotected person may be exposed without adverse biological changes in the eye or skin (ANSI Z136.1 2014). Hazard control measures can be grouped into three general categories:

- Engineering (e.g., enclosures, interlocks, beam stops)
- Administrative (e.g., policies, laser safety procedures, training)
- Personal Protective Equipment (e.g., eyewear, clothing)

Maximum emphasis should be placed on engineering control measures. However, if engineering controls are impractical or inadequate, warning devices, personal protective equipment, or administrative controls must be used.

Laser Treatment Controlled area (LTCA)

The LTCA is the room within which the HCLS is used, and the occupancy and activity of those within this area subject to supervision for the purpose of protection against all hazards associated with the use of HCLS. In a large room, a limited LTCA will be designated, clearly marked, and controlled.

- This area may be defined by walls, barriers, or other means.

- Personnel authorized to enter controlled areas shall be properly trained and must adhere to all applicable administrative, procedural, and operational controls.
- All personnel potentially exposed to hazardous levels of laser radiation shall wear appropriate protective eyewear.
- The entrances to an LTCA shall be posted with appropriate laser warning signs.

Protective Housing

During normal operation, the housing of the product that contains a laser must prevent access to laser energy, unless access to that energy is necessary for the product function. Protective housing is required on all classes of lasers. If it has panels or doors that can be opened during operation or routine maintenance by an operator and thus allow access to laser energy, interlocks are normally required.

Key Control

Only personnel qualified to use and operate the laser will have access to the laser key. Remove and secure the key when the laser is not in active use by authorized HCP.

Beam Alignment and Testing

All lasers require verification that the beam profile shape, e.g., as specified by the manufacturer or as anticipated, is correct to prior use. Beam alignment shall be completed prior to use in accordance with the procedures recommended by the manufacturer.

A surgical laser shall not be activated if there is a faulty alignment or beam shape.

Fiber Precautions

Maintaining fiber is mandatory for safe deliver of laser to the tissue. Practices to ensure the integrity of the fiber:

- Check the fiber carefully before each procedure.
- Inspect the distal and proximal fiber ends.
- Do not touch the end of the connector.
- Do not clamp the fiber to the drapes.
- Do not coil the fiber tightly.
- Cover the fiber tip with a wet sponge or towel.
- Check the aura or spot configuration of the fiber.

Smoke Evacuation

Smoke evacuators will help protect staff from exposure to LGAC, as well as improve the surgeon's field of view and reduce odors. The Healthcare facility (HCF) must use a smoke evacuator to adequately capture and remove LGAC from ablative procedures. See Appendix B for sample of a smoke evacuation policy and plan.

Some Evacuation

- Numerous types of **smoke evacuation systems** are available, including portable and mobile systems, disposable pneumoperitoneum systems, local stationary system, central stationary systems, and medical vacuum systems.
- Each department that uses smoke evacuators must have an internal policy that governs appropriate use of the evacuator per manufacturer recommendations. The policy will serve as a means to ensure consistent and appropriate use of the smoke evacuator by all staff and providers.
- Portable smoke evacuators use one or more different types of filters and absorbers that require monitoring and replacement on a regular basis. Filters are to be considered biohazard and shall be disposed of properly.
- Wall suction can be used in place of smoke evacuators for any procedures that **do not** involve surgery near tissues having high viral concentration or malignancy.

Respiratory Protection

- Respiratory protection that is at least as protective as a fit-tested surgical N95 filtering face piece respirator should be considered for use in conjunction with local exhaust ventilation in disease transmissible cases (e.g., HPV), during high-risk or aerosol transmissible diseases procedures (e.g., tuberculosis, varicella, rubella) and during aerosol-generating procedures (e.g., bronchoscopy).
- High filtration laser surgical masks should also be worn as an added measure of protection.

Warning Signs

The warning sign notifies users of the presence of a potential laser hazard inside the lab or space. Appropriate warning signs conveying the severity of hazards pertinent to the class of laser shall be posted at all entrances to the laser lab.

ORS will provide the appropriate warnings signs for the lab entrance posting after the lasers are registered. Reference Appendix A for warning signage.

Except for Class 1 lasers, all other lasers/laser systems should have appropriate warning labels. The labels shall be affixed to a conspicuous place on the laser housing or control panel.

The labels shall indicate the class of laser/laser system, wavelength, maximum power output, pulse duration (if applicable), and the precautionary instructions or protection action required for using the system.

Standard Operating Procedures

A written SOP is required for all Class 3B and Class 4 lasers or laser systems. The SOP must include a description of the following:

- Laser details (e.g. Laser class, mode, max output power/energy, pulse length, pulse repetition frequency)
- Laser system set-up
- Intended laser application.
- Operating procedures
- Routine alignment procedures
- Schematics of laser set-up
- Control measures
- Maintenance procedure
- Beam and non-beam hazards
- Personal protective equipment requirements
- Emergency procedure

The SOP shall be reviewed and followed by all users and must be available for access. The manufacturer's operating manual can be included in the SOP but is not a substitute for an SOP. All SOPs should be reviewed annually by personnel working with lasers to ensure the accuracy of the procedure(s).

Instrumentation

To ensure proper use of instruments to decrease the chance of a laser-induced fire or inadvertent eye or tissue damage from direct or reflected laser beam impact.

- Instruments can be ebonized (black) or anodized (matte-like finish) to decrease laser beam reflection reducing the risk of potential eye or fire injury. Laser instrumentation should not be etched because the surface will be disrupted, and this may allow reflection.
- Instruments may be covered with wet towels or sponges to decrease the chance of laser reflection.
- Stainless steel mirrors used to purposely reflect the laser beam must be inspected regularly for cracks or damages that would decrease the relative accuracy.
- Glass rods should NOT be used during laser surgical intervention because of the shattering that can occur from the laser energy absorption and heat build-up. Metal rods should not be used because of the heat absorption and

retention that could cause adjacent tissue damage. Teflon rods should not be used since they can melt and produce a toxic plume when struck by the laser beam.

- Pyrex, quartz, or titanium rods can withstand laser impact and thus decrease the chance of laser reflection or damage to the rod material. Clear pyrex or quartz rods will allow transmission of the argon and Nd:YAG beams.
- Proper endotracheal tube preparation should be performed to reduce the risk of endotracheal tube fires. A special “laser” endotracheal tube can be used that will withstand limited amounts of laser impact.
- Plastic instrumentation should not be used as they may burn or melt when struck by the laser beam.
- The instrumentation should test the laser impact on the material pre-op if there is any question as to the durability or flammability of the instrument in a laser environment.

Laser Protective Eyewear

The purpose of laser protective eyewear is to attenuate any laser radiation reaching one’s eye to a level below which it will cause injury. The laser user and laser operator must ensure that the appropriate eyewear is available for use and worn in the LTCA where Class 3B and Class 4 laser are present and there is a potential for exposure to the beam or reflected beams at levels above the MPE. The laser protective eyewear should be selected based on the level of protection required to protect the eyes from a worst-case scenario. The LSO can assist in selecting the proper laser-protective eyewear.

Factors in Selecting Appropriate Eyewear

- Laser wavelength
- Laser power and/or pulse energy
- Mode of operation (continuous wave or pulsed)
- Maximum exposure duration (assume worst case scenario)
- Maximum permissible exposure (MPE)
- Maximum Radiant exposure (J/cm^2) or Irradiance (W/cm^2) for which the protection is required.
- Optical density (OD) requirement of eyewear filters at the specific laser output wavelengths.
- For ultra-fast lasers, non-uniform bleaching may cause degradation of the rated OD of laser eyewear. Check with the manufacturer of the eyewear for the testing results to determine if the eyewear will provide adequate protection before using them.

Other considerations:

- Visible light transmission (VLT)
- Anti-fogging design or coatings
- Comfort and fit
- Impact resistance
- Side shields protection
- Prescription glasses

Labeling Eyewear

All laser safety eyewear shall be clearly labeled with the optical density and wavelength for which protection is afforded. Additional labeling may be added for identification purposes in labs with multiple lasers.

Inspection and Cleaning of Laser Eyewear

Periodic cleaning and inspection shall be performed to ensure eyewear is maintained in satisfactory condition. Use care when cleaning them, ensure proper storage and follow manufacturer instruction to avoid damage to the absorbing and reflecting surfaces.

For laser eyewear inspection, check for:

- Pitting, grazing, cracking, discoloration of the attenuation material
- Mechanical integrity of the frame
- Light leaks and coating damage

Laser Related Injury and Reports

Laser workers must report all laser accidents on site, no matter how minimal, to the PH responsible for the laser system involved. The PH must report any accidents causing injury or property damage to the LSO.

In the event of the suspected laser related injury:

1. Stop all laser work.
2. Seek medical attention asap.

Eye Exposure

- **During business hours:** Contact UW Occupational Medicine (609) 265-5610. They will assist in setting up an eye exam at Davis Duehr Dean.
- **After business hours:** Seek care at the nearest Urgent Care or Emergency Department.
- **In case of an emergency:** Dial 911
Laser eye exposures should be evaluated by an ophthalmologist as soon as possible.

Skin Exposure

- **During business hours:** Contact UW Occupational Medicine (608) 265-5610
- **After business hours:** Seek care at the nearest Urgent Care or Emergency Department
- **In case of an emergency:** Dial 911

After any accidental exposure or possible radiation injury:

1. Notify your supervisor immediately.
2. Notify the Office of Radiation Safety: radiationsafety@wisc.edu or (608) 262-3600
3. Contact UHS to arrange for medical evaluation.
4. Fill out the injury reporting forms and submit them through your department's human resources representative within 24 hours. <https://businessservices.wisc.edu/managing-risk/workers-compensation/>
5. The Office of Radiation Safety will investigate any suspected exposure and prepare the incident report.

Laser Transfer and Disposal

ORS shall be notified of any Class 3B, or 4 lasers or laser systems relocated, transferred to another PH or institution, or sent offsite as surplus equipment.

Permit holders or designees have an obligation to ensure safe and responsible disposition of their Class 3B or 4 lasers and laser components. Appropriate means of laser disposal includes:

- Transfer the laser to another lab that would have need for such a device.
- Return the laser to the manufacturer or to a vendor specializing in re-selling or disposing of used laser equipment.
- Eliminate the possibility of activating the laser by removing all means by which it can be electrically activated. Once this has happened the laser could then be cleared by ORS for disposal.
- Proper disposal of any hazardous materials found inside the laser components, such as mercury switches, oils, dyes, etc.
- Chemical Safety can help assist with the proper disposal of oils, mercury switches, dyes and other chemicals if used in lasers.
- Biological Safety can help assist with the proper disposal of sharps for fiber lasers.

Permit holders or designees should contact the proper safety department if they need further information or assistance with proper disposal. [Laser disposal and transfer form](#)

Further Information Example

For further information please contact the Office of Radiation Safety (ORS) at RadiationSafety@wisc.edu.

Please see the ORS website for more information. <https://ehs.wisc.edu/labs-research/radiation-safety/>

Glossary

Ablative procedures – Are procedures that involve the surgical removal of body tissue.

Accessible emission limit (AEL) – The maximum accessible emission level permitted within a particular laser hazard class.

Continuous wave (CW) – The output of a laser, which is operated in a continuous rather than a pulsed mode. In this standard, a laser operating with a continuous output for a period ≥ 0.25 s.

Health Care Facility (HCF) – For the purpose of this plan, any location where a laser is applied to veterinary patients for diagnosis of disease, or for preventive, cosmetic or therapeutic purposes, where bodily structure or function is altered, or symptoms are relieved.

Health Care Laser System (HCLS) – A laser system used in health care applications. The HCLS includes the laser or lasers, a delivery system to direct the output of the laser, a power supply with control and calibration functions, mechanical housing with interlocks, and associated liquids and gases required for the operation of the laser.

Health Care Personnel (HCP) – An individual directly involved with patient care.

Laser Generated Airborne Contaminants (LGAC) – Airborne contaminants generated when a laser beam of sufficient irradiance interacts with target materials. The materials include, but are not limited to, plastics, metals, ceramics, glasses, wood, and tissue. LGAC may be in the form of gasses, vapors or aerosols and often are a complex mixture of substances in all three states.

Laser Incidents – All laser incidents (accident or adverse events), no matter how minimal, shall be documented in an incident report. An ocular evaluation shall be made at the time of the incident if any injury is suspected. Any deviation from acceptable visual performance requires identification of the pathology either by fundoscopic examination or other deemed appropriate by the responsible medical examiner.

Laser Operator – A person responsible for setting up the laser prior to use or who operates the console to control the laser parameters under supervision of the user. This is the person who handles the laser equipment and in general controls the application of the laser radiation at the working area.

Laser Treatment Controlled Area (LTCA) – The room, within which the HCLS is used, and the occupancy and activity of those within this area are subject to supervision for the purpose of protection against all hazards associated with the use of the HCLS. In a large room, a limited LTCA can be designated if clearly marked and controlled.

Laser User – Is a person who is using the laser for its intended purpose within the user's scope of practice, training, and experience (also termed *laser surgeon* when appropriate).

Laser Safety Committee – The Committee operates under the authority of the Executive Radiation Safety Committee at the University of Wisconsin-Madison (UW-Madison) and UW Health (UW Hospital & Clinics and UW Medical Foundation locations). The Laser Safety Committee reviews and revises policies and procedures, establishes requirements based upon the ANSI and other applicable regulations.

Maintenance – Performance of those adjustments or procedures specified in user information provided by the manufacturer with the laser or laser system, which is to be performed by the user to ensure the intended performance of the product. It does not include *operation* and *service* as defined in this section.

Maximum Permissible Exposure (MPE) – The level of laser radiation to which veterinary personnel may be exposed without hazardous effects or adverse biological changes in the eye or skin. The criteria for MPE for the eye and skin are presented in *ANSI Z136.1-2000*, section 8.

Medical Device Labeling – A term used in conjunction with FDA Medical Device Regulations 21 CFR 801 to indicate intended and approved use. “Labeling” in this context is in the manual and is required to supply adequate direction and information of the intended use of the device. An adequate direction for use means directions under which the user can use a device safely and for the purposes for which it is intended.

Medical Laser Safety Officer (MLSO) – This person is responsible for the safe use of the lasers in the Health Care Facilities.

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

Nominal Ocular Hazard Distance (NOHD) – The distance along the axis of the veterinary personnel eye beyond which the irradiance or radiant exposure during normal operation is not expected to exceed the appropriate MPE.

O.D. – Optical density – The ability of a lens to filter out a specific wavelength or wavelength range.

Standard Operating Procedures (SOP) – Written procedures that list administrative safety measures.

Wavelength – The distance between two successive points on a periodic wave which have the same phase.

Appendix A: Safety Signage

“DANGER” signs are posted when the laser is in use for operation.

“Notice” signs are posted during maintenance.



DANGER

Class 4 Laser Controlled Area
Avoid eye or skin exposure to direct or scattered laser radiation.

Laser Surgery in Progress
Do Not Enter When Laser Warning Light is On

Laser System & Type	Wavelength	OD
Ultra Pulse Type: CO2 Max Output Power: 60W Pulse: 225 mJ Pulse width: 2 ms	10,600 nm	≥ 4

Environment, Health & Safety
21 N Park St, Madison, WI 53715
www.ehs.wisc.edu
LaserSafety@ehs.wisc.edu; 608.262.3600

UWHealth



NOTICE

Laser Alignment or Repair in Progress

Only Authorized Personnel
Eye Protection Required

Class 4

Notice signs are used when lasers are being repaired.

safety
Mail: LaserSafety@wisc.edu;
ehs.wisc.edu

Appendix B: Surgical Smoke Evacuation Policy & Plan

Sample safety P&P for the surgical smoke evacuation.

Surgical Smoke Evacuation P&P

POLICY:

To manage the hazards of surgical smoke plume and to protect patients and health care providers from those hazards, smoke evacuation shall be used.

PROCEDURE:

- A. Smoke evacuation system must be adequate to handle the amount of plume produced during surgical procedures.
 - a. Shall be used for every procedure in which plume is generated.
 - b. Filtered wall suction may be used on procedures producing minimal plume, e.g. carotid endarterectomy, laparoscopic procedures.
 - c. ULPA (Ultra Low Particulate Air) smoke evacuator shall be used on procedures producing plume and/or laser generated airborne contaminants.
- B. Examine smoke evacuator to ensure that the filter is appropriately loaded.
- C. Position smoke evacuator for maximum effectiveness, depending on surgical procedure.
 - a. PenAdapt tubing may be used on the ESU (Electrosurgical Unit) active electrode hand piece.
 - b. Straight tubing may be secured close (within 2 cm) to the working area to effectively evacuate plume.
 - c. Avoid direct contact with the patient's skin.
- D. When using the smoke evacuator with the ESU, the unit will be equipped with a remote switch to activate when the ESU is operating. When used with the laser, the smoke evacuator's foot pedal should be activated by the surgeon or laser operator.
- E. Adjust the setting and vacuum intensity as needed depending on the amount of plume.
- F. At the conclusion of the surgical procedure, replace the smoke evacuator filter according to the manufacturer's instructions.
 - a. The used filter is placed in a red biohazard bag for disposal when the timer reaches limit of hours or at the nurse's discretion when it is visibly soiled.
- G. Consult the operator manual for complete instructions.

Appendix C: Laser Safety Checklist

Sample laser safety checklist before operation.

Equipment Information	
1. Laser Manufacture: _____	
2. Laser Type (e.g. CO2/Diode/ Ho:YAG): _____	
3. Setting and Application Information	
a. Mode: Continuous (CW)/ Pulse (single, multiple, super)	
b. Wavelength (nm): _____	
c. Pulse frequency (Hz): _____	
d. Power setting (Watts/Joules): _____	
Room Preparation	
1. Laser warning sign	<input type="checkbox"/> Yes <input type="checkbox"/> No
2. Doors closed	<input type="checkbox"/> Yes <input type="checkbox"/> No
3. Laser eyewear available and extra outside of the room	<input type="checkbox"/> Yes <input type="checkbox"/> No
4. Windows covered with proper laser safe material	<input type="checkbox"/> Yes <input type="checkbox"/> No
5. Electrical cords, plugs, outlets, and cover plates in good condition	<input type="checkbox"/> Yes <input type="checkbox"/> No
6. No extension cords used	<input type="checkbox"/> Yes <input type="checkbox"/> No
7. Laser key and power switch show no signs of damage	<input type="checkbox"/> Yes <input type="checkbox"/> No
8. Laser device tested prior to use	<input type="checkbox"/> Yes <input type="checkbox"/> No
9. Protective eyewear available and worn by all personnel	<input type="checkbox"/> Yes <input type="checkbox"/> No
10. Protective masks available	<input type="checkbox"/> Yes <input type="checkbox"/> No
11. Moist towels, gauze, and sponges available	<input type="checkbox"/> Yes <input type="checkbox"/> No
12. Sterile water/fluids available	<input type="checkbox"/> Yes <input type="checkbox"/> No
13. Instruments in direct line of Laser beam are non-reflective or covered with a moist item	<input type="checkbox"/> Yes <input type="checkbox"/> No
14. Microscope inspected	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
15. Filter cable used on microscope (e.g., green diode Laser used for ear cases)	<input type="checkbox"/> Yes <input type="checkbox"/> No
16. Microscope filter used (e.g., green diode Laser used for retina cases)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
17. Smoke Evacuator use	<input type="checkbox"/> Yes <input type="checkbox"/> No
18. Smoke evacuator positioned appropriately, and tubing connection attached appropriately to suction	<input type="checkbox"/> Yes <input type="checkbox"/> No
19. Laser in standby mode when not in use, repositioning, or changing Laser Operator	<input type="checkbox"/> Yes <input type="checkbox"/> No

Patient Preparation	
20. Patient eyes protected.	<input type="checkbox"/> Yes <input type="checkbox"/> No
21. Type of patient eyewear: Corneal eye shield/ laser eyewear/ moistened eye pads/ other: _____	
Fire Safety	
22. FiO2 at < 30%	<input type="checkbox"/> Yes <input type="checkbox"/> No
23. No Nitrous Oxide (N2O) used	<input type="checkbox"/> Yes <input type="checkbox"/> No
24. Laser-rated endotracheal tube used	<input type="checkbox"/> Yes <input type="checkbox"/> No
25. Endotracheal tube cuff inflated with saline or dye	<input type="checkbox"/> Yes <input type="checkbox"/> No
26. Only water-based solution used: (no petroleum or oil-based ointments)	<input type="checkbox"/> Yes <input type="checkbox"/> No
27. FiO2 at < 30%	<input type="checkbox"/> Yes <input type="checkbox"/> No
28. No Nitrous Oxide (N2O) used	<input type="checkbox"/> Yes <input type="checkbox"/> No
29. Laser-rated endotracheal tube used	<input type="checkbox"/> Yes <input type="checkbox"/> No
30. Endotracheal tube cuff inflated with saline or dye	<input type="checkbox"/> Yes <input type="checkbox"/> No
Closing	
31. Tissue protection removed (i.e., rectal)	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
32. Laser hand-piece and attachment returned	<input type="checkbox"/> Yes <input type="checkbox"/> No <input type="checkbox"/> N/A
33. Laser key returned	<input type="checkbox"/> Yes <input type="checkbox"/> No
34. Laser cleaned	<input type="checkbox"/> Yes <input type="checkbox"/> No
35. Laser stored properly	<input type="checkbox"/> Yes <input type="checkbox"/> No