Laser Safety in Veterinary Practice

Prepared by:

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Laser Safety in Veterinary Practice

Introduction:
Veterinary laser safety issues are similar to human surgical medicine safety issues –

Education for SAFE USE is essential
Introduction:

“LASER”

is an acronym for

Light Amplification by

Stimulated Emission of Radiation
Introduction:

Lasers produce an intense beam of light (U-V, visible or I-R).

The beam may be continuous or pulsed and is used for cutting or sealing tissue.
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Introduction:

The benefits of laser surgery include:

- Decreased bleeding,
- Smaller blood vessels are sealed,
- Decreased pain in post operative recovery,
- Destruction of bacteria
A brief inadvertent exposure to Class 3 or Class 4 laser radiation will cause permanent eye injury and/or skin burns.
Introduction: Education and safe work procedures give the Designated Member (DM) and operating staff essential information for laser safety.
The DM is responsible to the CVBC for the management and practice of veterinary medicine and their obligation to take additional measures to prevent health and safety hazards from occurring in the veterinary facility.
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Introduction:

The use of lasers is subject to provincial legislation governing worker health and safety.
Introduction:
The Occupational Health and Safety Regulation states:

“Equipment producing ionizing or non-ionizing radiation must be installed, operated and maintained in accordance with the applicable standard, as listed in the regulation.”

See section 7.23(c) for more detail
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Introduction:

An Officer from WorkSafeBC (formerly known as the Workers’ Compensation Board) may visit a site and inspect for compliance with the Occupational Health and Safety Regulation (OHSR).
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Introduction:

CVBC Responsibility

CVBC will not test or assess machines but will monitor whether:

1. Members have their machines properly maintained,

2. The facility has proper standards for safe use, and

3. Procedures are in place for all staff to comply with the requirements of the OHSR.
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Health Canada has regulations governing the design, construction and performance of lasers,

BUT, has no regulations governing importation of lasers into Canada – so beware of purchasing non-conforming products!
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Introduction:

Lasers fall into two categories –
1. Lower power lasers – Class 1 or 2
e.g. some laser pointers, some alignment lasers for home use, supermarket checkout lasers
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Introduction:

2. Higher power lasers – Class 3 or 4
   e.g. industrial lasers, entertainment lasers, surgical lasers, skin therapy, removal of tattoos, hair, spider veins, spots, moles, warts etc.
Laser apps in veterinary medicine include:

Declawing, surgery, dermatology, ophthalmology, upper respiratory tract, urinary and G.I. tracts, wound management etc.
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Lasers are classified from lowest power to highest power –

Classes 1, 2, 3R, 3B and 4

The label on the laser must indicate the class, thus indicating the degree of hazard to humans and patients during the laser use.

The label must also identify the maximum power output and the wavelength of the laser emission (or the type of laser e.g. Nd-YAG)
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LASER RADIATION – AVOID DIRECT EXPOSURE TO BEAM
650 nm Diode Laser System
Max Output < 245 mW
Class IIIb Laser
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The higher laser emission levels – from Class 3 or Class 4 lasers – are instantly hazardous to unprotected eyes and skin.

The hazard is from exposure to the direct beam or the reflected beam. For Class 3B and 4, the hazard is also from the scattered beam.
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The direct beam may also be a fire hazard, when striking combustible materials.

Operator education and training specific to the laser (and the laser class) is essential for safe use.
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Roles and Responsibilities:
The overall safety program associated with the use of lasers remains the responsibility of the DM.

Class 3B and 4 lasers require the appointment of a Laser Safety Officer (LSO), who is responsible for implementing a laser safety program.
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Roles and Responsibilities:

The DM and LSO must ensure that the laser operator is aware of the requirements for safe use.
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Roles and Responsibilities:

Excerpts from Section 1.3.1 of the ANSI Standard………

- The LSO is the one person in each facility or organization responsible for the laser safety program.
- This individual has the training and experience to administer a laser safety program.
- The LSO shall effect the knowledgeable evaluation and control of laser hazards.
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Roles and Responsibilities:
Duties of the LSO

1. Hazard Classification
2. Hazard Evaluation
3. Hazard Response

The specific detail for each of these duties is provided in ANSI Standard Z136.3 - 2011
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Roles and Responsibilities:
Duties of the LSO

4. Control Measures
5. Procedure Approvals
6. Protective Equipment

The specific detail for each of these duties is provided in ANSI Standard Z136.3 - 2011
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Roles and Responsibilities:
Duties of the LSO

7. Signs and Labels
8. Facilities and Equipment
9. Training

The specific detail for each of these duties is provided in ANSI Standard Z136.3 - 2011
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Roles and Responsibilities:

The laser operator must be trained in laser safety and safe procedures,

The laser operator must be aware of the requirements of the DM and LSO and be aware of local regulations concerning laser use.
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Laser light is coherent – maintaining a fixed phase relationship.

Laser light is monochromatic – i.e. composed of one wavelength and only one frequency.

Wavelength is measured in meters – and denoted by “micro” (µ) 10^{-6} or “nano” (n) 10^{-9}
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Common Veterinary lasers:

- Carbon Dioxide  (10,600 nm)
- Nd:YAG        (1064 nm)
- Ho:YAG        (2100 nm)
- K-laser       (800 and 970 nm)
- KTP           (532 nm)
- Argon         (488 to 514 nm)
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Unless laser light is caused to diverge by special optics, it is non-divergent.

The exposure danger may extend for miles!
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Increasing laser energy decreases the time needed for tissue vapourization.

More rapid tissue vapourization can be achieved by:

- Increasing the beam power
- Decreasing the beam diameter
- For pulsed lasers, increasing the energy per pulse or reducing the pulse rate.

Pain and tissue damage are reduced by pulsing – allowing the tissue to recover between pulses.
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Laser Considerations:

Choose a laser wavelength, so that most of the light energy is........ absorbed &/or transformed
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Laser Considerations:

When absorbed or transformed within the target tissue, the laser energy interactions are classified as Photothermal.
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Laser Considerations:

Heat energy conducted to tissue results in hyperthermia and collateral tissue damage.

Carbon black char can act as a foreign substance, creating an inflammatory response and impede would healing.
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Laser Considerations:

Photochemical

Laser light is absorbed and converted into chemical energy, resulting in tissue destruction
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Laser Considerations:

Photochemical

Photodynamic therapy (PDT) use laser-activated photosensitizer........administered intravenously, orally or topically.

The process stimulates destruction of chemically labeled tissue.
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Laser Considerations:

Mechanical-Photodisruptive

Pulsed laser light can be converted into acoustical energy upon impact, creating a shock wave that disrupts the target tissue

(e.g. laser intracorporeal shock wave lithotripsy)
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Laser Considerations:

Laser energy applied to target tissue may be scattered forward in and through the tissue causing heating and necrosis.
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Laser Considerations:

Backscatter can occur from partial reflections on impact with tissue.......... 

This may have a damaging effect on staff and equipment if adequate safety precautions are not devised and followed.
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Laser Considerations:

Nd:YAG and argon lasers are known to produce backscatter – this can be helpful in cauterizing bleeders below the tissue surface.

The Nd:YAG laser penetrates 4 – 5 mm with large amounts of forward and backscatter.
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Laser Considerations:

Visible Argon laser

a. Is highly absorbed by haemoglobin
b. Has 2 – 3 mm penetration
c. Moderate forward and backscatter
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Laser Considerations:

Carbon dioxide (CO$_2$) laser’s far infra-red radiation is highly absorbed by water.

It is rapidly absorbed within the first 0.1 to 0.3 mm of tissue

It makes a good cutter but poor cauterizer.
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Laser Considerations:

The carbon dioxide laser is one of the most widely used lasers.

Heat diffusion into tissue surrounding the target results in collateral damage.
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Laser Considerations:

Lowering the laser power setting does not necessarily improve things…….

…. less power requires longer contact times to produce the desired effect…….

…. which results in increased heat diffusion into surrounding tissue (i.e. more pain)
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Laser Considerations:

Alternatively:

“Superpulsing” of laser energy can allow tissue recovery between micropulses.

The microsecond pulse is shorter in duration than the time required for diffusion of heat through tissue.
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Laser Considerations:

……... this allows thermal energy to dissipate, primarily through vapourization. This results in minimal collateral heat diffusion.
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Laser Hazards:

The primary exposure associated with lasers is inadvertent exposure to the laser beam.

Exposures to staff or patients occurs from the direct laser beam or a reflected beam off a shiny surface, such as a mirror, ring, glass picture, refrigerator, chromed faucet.
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Laser Hazard

Visible and near infra-red laser light passes through the cornea, pupil and the lens and is focused onto a small area of the retina, resulting in a major increase in the energy/power absorbed at the fovea.
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Laser Hazard:

The energy or power per unit area on the retina can be increased 10,000 to 100,000 times.
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Laser Hazard:

The eye cannot see infra-red or ultra-violet radiation......
.....it will NOT blink to protect itself, nor will there be a reflex to look away.

Brief exposures can instantaneously produce permanent damage to the retina.
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Laser Hazard:

Eye damage can occur without any awareness of the exposure.
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Laser Hazard:

Everyone (including the patient) in the operating area is at risk of eye injury when not using eye protection!

It is extremely important that all persons entering the laser area be provided with, AND WEAR, laser protective eyewear.
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Laser Hazard:

417 reported laser accidents/events from 1964 to 2001 revealed that 70% of all laser accidents have been related to:

- Not wearing protective eyewear,
- Wearing inappropriate eyewear,
- Wearing damaged protective eyewear ……

……..while using the laser!
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Laser Hazard:

Laser protective eyewear is the single most important piece of protective equipment in the treatment area!!
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Laser Hazard:

To avoid eye damage:

Laser protective eyewear MUST be labeled with the same wavelength as is emitted by the laser to be used.

e.g. 10,600 nm for CO₂
1064 nm for Nd:YAG

Always check the labeling of the goggles!
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Laser Hazard:

To avoid eye damage:

Laser protective eyewear must also be labeled with the optical density (OD) number.

The OD of laser protective eyewear is unique to the energy/power of the laser and the laser’s wavelength.

Always check the labeling of the goggles!
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Laser Hazard:

To avoid eye damage:

Laser protective eyewear must have an OD recommended by the laser equipment manufacturer.

This will typically be an OD of 5 or greater.
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Laser Hazard:

To avoid eye damage:

There is a 10x increase in protection for each increase in OD

<table>
<thead>
<tr>
<th>Optical Density</th>
<th>% of transmitted laser light</th>
</tr>
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<tbody>
<tr>
<td>0</td>
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<td>1</td>
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<tr>
<td>5</td>
<td>0.001</td>
</tr>
<tr>
<td>6</td>
<td>0.0001</td>
</tr>
</tbody>
</table>
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Laser Hazard:
To avoid eye damage:

An optical density of six (OD=6) allows one millionth of the laser light to be transmitted through the lens of the eyewear.

Why is this protection needed?
- the power of the laser
- the eye’s ability to focus the power of the beam on the retina.
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Laser Hazard:

To avoid eye damage:

1. **Always confirm** the wavelength number and OD number before using the protective eyewear.

2. **Ensure** that the wavelength matches that emitted by the laser being used.

3. **Ensure** that the OD number is not lower than that recommended by the laser manufacturer.
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Laser Hazard:

To avoid eye damage:

Laser protective eyewear **must** be worn in the laser treatment area.

Sunglasses and/or contact lenses do not provide protection from the laser beam.
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Laser Hazard:

To avoid eye damage:

- Laser protective eyewear must have effective side protection.
- Laser protective eyewear must have side and top guards and fit snugly around the nose.
- Laser protective eyewear must be stored in the dark, when not in use.
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Laser Hazard:

To avoid eye damage:

Laser protective eyewear should not move between laser treatment rooms, or be carried in pockets between use.
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Laser Hazard:

To avoid eye damage:

If recommended by an optometrist, staff working with a laser should have their eyes examined prior to their first occupational exposure.
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Laser Hazard:

To avoid eye damage:

Never permit a laser beam to be pointed directly at a person’s eye!!

- even if protective eyewear is worn.
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Laser Hazard:

To avoid skin damage:

Damage from direct or reflected laser light, which may appear as an erythematous reaction or maybe severe sunburn, can be avoided by wearing gloves and a gown.

Use of drapes and sponges moistened with sterile saline may afford some protection to the worker from reflected laser energy.
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Laser Hazard:

To avoid exposure from reflection and transmission:

Windows in the laser treatment area must be covered.

Window covers need to be non-flammable, opaque material – labeled with the OD number.
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Laser Hazard:
To avoid exposure from reflection and transmission:
Window glass has an OD of 5 for short wave ultraviolet and long wave infra-red, without being covered.

Note: for the long wave infra-red, reflection is a hazard.

Window glass provides adequate protection to ultraviolet in the range of 180 nm to 300 nm.
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Laser Hazard:
To avoid exposure from reflection and transmission:

Window glass has an OD of 5 for:
Excimer argon fluoride laser at 193 nm
Excimer krypton fluoride laser at 248 nm.
Greater than 4000 nm,
such as the CO₂ laser at 10,600 nm (but remember the reflection hazard)
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Education, training and standards:

Understanding laser wavelength, tissue penetration and potential hazards with laser use, and Utilizing the recommended standards for safe operation....

.... are essential requirements for the surgeon and operating staff to provide a laser safe environment.
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Education, training and standards:

1. ANSI Standard Z136.1 – 2007, Safe Use of Lasers;
2. ANSI Standard Z136.3 – 2011, Safe Use of Lasers in Medical Facilities;

Note: the latter two are identical, except for a page of Canadian deviations at the beginning.
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Education, training and standards:

The Occupational Health and Safety Regulation (OHSR) enforces the current version of each standard.
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Education, training and standards:

WorkSafeBC website, www.worksafebc.com provides detailed explanatory material in the Guidelines attached to each section of the Regulation.

Laser information can be found in the Guidelines for Part 7 of the OHSR.
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Education, training and standards:

Section 7.19(4)(b) of the OHSR requires an employer to ensure that a worker’s exposure to non-ionizing radiation does not exceed exposure limits specified for lasers.
BUT, the determination of worker exposure to laser radiation is very complex. Calculation of the exposure limit is dependent on the specific laser in use.

There is no generic calculation covering all laser sources.
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Education, training and standards:

THUS, neither a WCB Officer nor an employer is expected to measure the radiation being emitted by a laser.
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Education, training and standards:

Rather, compliance with this section will be determined by an evaluation of the Laser Safety Program, as outlined in table 10 of the ANSI Standard, Z136.1 – 2007.

Workers cannot be overexposed to laser radiation if there is an effective laser safety program in place.
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Education, training and standards:

The ANSI Standards require laser facilities, regardless of their size, to establish and maintain an effective safety program for the control of laser hazards.
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Education, training and standards:

As stated earlier, the employer has the fundamental responsibility for assurance of the safe use of lasers owned and/or operated by the employer or any employee.

The DM must appoint a Laser Safety Officer (LSO) for the facility – if there is a class 3B or class 4 laser on the site.
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Education, training and standards:

The DM may be the Laser Safety Officer but the LSO must be designated and be given the authority to implement and run the Laser safety program in the facility.

The LSO must have sufficient training and experience to develop and administer a laser safety program.
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Safety Zones:

The distance beyond which it is safe to view or be exposed to a laser beam is unique for each type of laser – and depends on many factors.

Typically, this is a very large distance!

Standards define the area inside this distance as the Nominal Hazard Zone (NHZ).
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Safety Zones:

It is simple to define an area where the laser is used and exposures in this area exceed the maximum permissible exposure.

Safety precautions are then mandatory in this area.................
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Safety Zones:

.................Designate the laser operating and/or treatment room as the NHZ.

Prevent inadvertent exit of the direct or scattered beam through open doors, windows or other breaks in the treatment room enclosure.
Safety Zones:

Access into the NHZ – i.e. the treatment room – must be restricted to essential personnel during treatments.
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Safety Zones:

Appropriate warning signs MUST be identified at all entrances to the treatment area.
Safety Zones:

The entry warning sign(s) can be a larger version of the laser warning label that is attached to the laser.
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Safety Zones:

Additional wording recommended for ANSI entrance signs include:

“Eye Protection is Required”
“Laser Protective Eyewear Required”
“Invisible Laser Radiation”
“Do not enter when light is on”
“Restricted Area”
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Safety Zones:

Fire-proof, lightweight laser-blocking covers with magnetic sides are available for covering exit points, such as windows.

Reflective items must not be used or worn in the laser treatment area.
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Standard Operating Procedures:

Safety policies and procedures must be established and copies posted…….

…………..including,

- Authorizations for laser use,
- Operating instructions,
- ‘prior-to-use’ checklists (see final 3 slides),
- Maintenance/service instructions.
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Standard Operating Procedures:

Equipment must be serviced and maintained as recommended by the manufacturer....to ensure that the laser operates as intended and that safeguards remain functional.
Safety Features:
Newer lasers often have sophisticated built-in safety features:
- Protective housings around the laser,
- Interlocks on the protective housings,
- A key control and warning system.

To prevent unauthorized operation, securely store the laser and/or require a key or coded access to enable the laser.
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Safety Features:
The switch controlling patient exposure must be guarded to prevent inadvertent activation, or require two simultaneous actions, such as foot pedal depression AND a hand trigger to operate the laser.
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Safety Features:

There must be an emergency shut-off switch available to the operator or assistant for rapid shut-down.

The laser operator and LSO must periodically check:
- Interlocks and safety switches are functional,
- Electrical cords for damage,
- Skin coolant hoses for wear or damage.
Non-Beam Hazards:

The interaction of the laser beam with tissue produces a plume of smoke that may contain bacterial and viral particles (0.1 to 0.3 µm), that may be inhaled by the operator or patient.
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Non-Beam Hazards:

Hazardous chemicals may also be released in the plume – such as benzene, formaldehyde, phenol and toluene - some of which are carcinogens.
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Non-Beam Hazards:

To avoid the inhalation of aerosols, appropriate air evacuation systems must be used!

The complexity of the evacuation system is determined by the beam power.
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Non-Beam Hazards:

Surgical Smoke Evacuation in Procedural Areas

Terri Link RN, MPH, CNOR, Katherine A. Halverson-Carpenter RN, MBA, CNOR

Background
- Smoke produced from ablated human tissue is equivalent to smoking cigarettes and contains the same chemicals.
- It produces an offensive odor, and can cause ocular and upper respiratory irritation.
- Current practice for evacuation of smoke included a combination of a centralized smoke evacuation system, free standing units and standard vacuum.
- Older smoke evacuators produced a high noise level.
- Surgery Clinics were using smoke evacuators for laser plume, but not for smoke generated from ESU units.
- Clinic procedure rooms contained no centralized suction.

Purpose
- Evaluate current practice of smoke evacuation in procedural areas.
- Identify gaps in compliance with Joint Commission standards of care.
- Standardize product use.
- Develop policies and procedures for evacuation of surgical smoke.

Methods
- Observational data was obtained from procedural areas which produce smoke. Data included effectiveness and noise level of smoke products and evacuators, free standing and centralized.
- Barriers were identified:
  - Multiple smoke evacuation products and evacuators
  - Increase in number of products needed and cost
  - Compliance
  - Centralized smoke evacuation system not fully functional
  - Multiple products, vendors, and technology
  - Multiple levels of smoke evacuation needed.

Results
- Evacuation products were evaluated and decisions were made to standardize products and practice.
- A policy was drafted for smoke evacuation for all procedural areas.
- A plan was developed to gradually introduce products to surgeons and operating room staff.
- Not all surgeons supported conversion from standard ESU pencil to smoke evacuation product.
- A customized approach was presented to staff and surgeons and a variety of options made available to meet requirement of smoke evacuation for procedures producing smoke.

Implications for Perioperative Nursing
- Instituting a new policy based on regulations can only be successful if a planning model is put into place.
- Identifying stakeholders, resources, and barriers is imperative for a successful process improvement.
- As with any regulatory change, there is a period of adaptation to change which should be considered in planning education and implementation.
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Non-Beam Hazards:

To control the dispersion of the laser plume containing toxic gases and biological particles, place the capture device 2 to 5 cm from the point of production (treatment area).

The plume must be completely trapped and then vented out of the area in an environmentally safe manner.
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Non-Beam Hazards:

Portable smoke extractors using charcoal and HEPA filters are acceptable.

See ‘Control of Smoke from Laser/Electric Surgical Procedures’ on the NIOSH web-site –

www.cdc.gov/NIOSH/hc/html

NIOSH – National Institute for Occupational Safety and Health
Non-Beam Hazards:

The filters and absorbers in portable smoke evacuators require regular replacement.

Local exhaust ventilation techniques serve as the first line of protection from exposure to the hazardous components of the laser-generated plume.

(See ANSI Z136.3 -2011, section 7.4.2.1)
ANSI Standard Z136.3 – 2011, section 7.4.2.3 states: There is no suitable half-mask respirator used for the specific purpose of excluding all laser generated plume particulates, bacteria, viruses, gases, vapours or other irritants.

Surgical masks are NOT designed to provide protection from plume contents.

Surgical masks are intended to protect the patient from the contaminated nasal or oral droplets of anyone with access to the surgical field.
Non-Beam Hazards:

Surgical masks do not provide any protection to the wearer!

Filter masks that filter >0.2 µm particles (and rated for laser use) are available, such as a P100 filter respirator (HEPA).
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Non-Beam Hazards – Fire Safety:

Lasers should not be used in the presence of:

- Flammable anaesthetics,
- Prep solutions containing alcohol drying agents,
- Petroleum-based ointments,
- Flammable plastics,
- Other organic solvents.
Non-Beam Hazards – Fire Safety:

It is recommended that:

a. Surgical drapes made of flame-retardant material, protected with moistened towels and sponges, are located near the primary laser beam,

b. Water and a fire extinguisher should be readily available.
Non-Beam Hazards – Fire Safety:

It is recommended that:

c. Use of adequate prep towels and the insertion of a moistened sponge in the anal opening to reduce the release of methane gas when performing surgery in the perineal area.

d. Use of intravenous anaesthetic technique instead of a volatile gas anaesthetic, when practicable.
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Non-Beam Hazards – Fire Safety:

It is recommended that:

e. Since an oxygen-rich environment will increase the fire hazard, use “laser safe” endotracheal tubes, that may include:

- Non-flammable metal tubes,
- Specially wrapped red rubber tubes, or
- 100% silicone tubes
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Non-Beam Hazards – Fire Safety:

The cuff of the endotracheal tube should be filled with saline.

Protect the endotracheal tube with moistened sponges.

Note: The ANSI Standard has a large section (7.6.2) dealing with the risk of endotracheal fires!
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Non-Beam Hazards – Fire Safety:

Ensure there is adequate electrical supply (amperage and voltage) for the laser, and avoid fluids which could result in a short circuit.

Proper grounding and insulation are imperative.
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Non-Beam Hazards – Conclusion:

The DM must keep records and have them available on-site:

Records include:

- Laser operator qualifications,
- Standard operating procedures,
- Safety checklist,
- Previous safety inspections,
- Reports of accidents or incidents.

All records must be legible and retained.
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Non-Beam Hazards – Conclusion:

Surgical lasers are powerful and potentially dangerous instruments.

Misuse can result in severe injury to the animal or to the occupationally exposed veterinarian.
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Non-Beam Hazards – Conclusion:

Protection is relatively easy……..

With effective training and safe work procedures, the potentially exposed veterinarian and staff can ensure their protection, and that of the animal.
Laser Safety in Veterinary Practice

References:

“Lasers – Have You Seen The Light?”
By Timothy Holt, DVM

Proceedings and Notebook, CANWEST
Veterinary Conference, 2005
Laser Safety in Veterinary Practice

References:

The Laser Institute of America
12424, Research Parkway, Suite 125,
Orlando, Florida 32826
www.lia.org

Rockwell Laser Industries Inc.
PO Box 43010, Cincinnati, OH 43010
Toll free 513-217 1598
Laser Safety in Veterinary Practice

References:

The Radiation Protection Services,  
BC Centre for Disease Control,  
655, West 12th. Avenue, Vancouver  
Phone: 604-707-2442

WorkSafeBC  
Prevention Information Phone Line,  
604-276-3100  
Toll Free: 1-888-621-7233
# Laser Safety in Veterinary Practice

## Laser Safety Checklist (page 1):

<table>
<thead>
<tr>
<th>✓</th>
<th>Procedure</th>
<th>Operator’s Initials</th>
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<tbody>
<tr>
<td></td>
<td>Correct wavelength of goggles?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laser safety goggle wavelength blocks laser wavelength in use?</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Laser treatment area clear of reflective items; e.g. reflective surfaces, mirrors, steal sinks, taps, glass, etc?</td>
<td></td>
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<tr>
<td></td>
<td>Patient’s eyes, skin, etc. protected?</td>
<td></td>
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<tr>
<td></td>
<td>Record OD of protective goggles. ((OD = \log_{10}(\text{laser beam power} / \text{MPE})))</td>
<td></td>
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<tr>
<td></td>
<td>Warning sign outside laser door?</td>
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<tr>
<td></td>
<td>Warning notices posted?</td>
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<tr>
<td></td>
<td>Laser &amp;/or electrosurgical smoke masks available?</td>
<td></td>
</tr>
</tbody>
</table>
## Laser Safety in Veterinary Practice

### Laser Safety Checklist (page 2):

<table>
<thead>
<tr>
<th>√</th>
<th>Procedure</th>
<th>Operator’s Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td><strong>Use of laser protective clothing, gloves, etc.?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Anesthetic machine inspected?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Emergency shutdown procedure posted?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Laser treatment area clear of unauthorized personnel?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>MPE - Maximum Permissible Exposure – AREA clearly defined?</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Record average power of laser.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Record laser classification used.</strong></td>
<td></td>
</tr>
<tr>
<td></td>
<td><strong>Record name of laser operator.</strong></td>
<td></td>
</tr>
</tbody>
</table>
Laser Safety Checklist (page 3):

<table>
<thead>
<tr>
<th>Procedure</th>
<th>Operator’s Initials</th>
</tr>
</thead>
<tbody>
<tr>
<td>Smoke evacuation working?</td>
<td></td>
</tr>
<tr>
<td>Fire extinguisher/water available?</td>
<td></td>
</tr>
<tr>
<td>Presence of laser safety official?</td>
<td></td>
</tr>
<tr>
<td>Preventative maintenance of laser up to date?</td>
<td></td>
</tr>
<tr>
<td>Name of person holding ‘safety key’?</td>
<td></td>
</tr>
<tr>
<td>Permanent location of safety key?</td>
<td></td>
</tr>
<tr>
<td>Name of emergency contact?</td>
<td></td>
</tr>
<tr>
<td>Laser designated as controlled area?</td>
<td></td>
</tr>
<tr>
<td>Operator’s laser manual available?</td>
<td></td>
</tr>
<tr>
<td>Contact information of manufacturer?</td>
<td></td>
</tr>
</tbody>
</table>