LASER SAFETY PROGRAM
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1 Purpose and Requirements
This guide presents a summary of the basics of laser safety, biological effects, and exposure limits to be used at Cornell University. This guide applies to all laser classes. Some recommendations will enhance laser safety in the laboratory while others are required by regulations or nationally accepted laser safety standards.

Questions or comments concerning this program may be sent to radiation-safety@cornell.edu.

2 Scope
This guidance applies to all users of laser equipment. Because of the wide variety of lasers and laser uses that are possible, this guide provides performance based goals rather than prescriptive requirements. Implementation of the goals is left to the principle investigator, supervisor, and the laser safety officer and will be designed to meet the research and safety needs of the particular application.

3 Definitions
- Laser Safety Officer (LSO): One who has authority and responsibility to monitor and enforce the control of laser hazards and to effect the knowledgeable evaluation and control of laser hazards.
- Laser: Light Amplification by the Stimulated Emission of Radiation
- MPE: Maximum Permissible Exposure as listed in ANSI Z136.1 standard. The maximum allowed exposure to the eye or skin to laser radiation.
- Nominal Hazard Zone (NHZ): The space or area where laser radiation levels exceed the MPE. For example, the NHZ could be an entire room, or a smaller area within a room that is surrounded by barriers to contain the beam.
- Visible light: Wavelengths between 400 nm and 700 nm.
- Invisible light: All other wavelengths below 400 nm and above 700 nm.
- Optical Density (OD): The power of 10 reduction in intensity through the eye protection. For example, an OD of 3 means 1/1000 of the laser intensity passes through eye protection.
- Entryway: A door, passage, or entrance from a public area, or non-laser use area, leading into the NHZ or laser use area.

4 Responsibilities
4.1 Principle Investigator or Supervisor / Manager
The PI or supervisor is responsible for the health and safety of those reporting to him/her. They are also responsible for ensuring that lasers are properly installed and used, laser users have been
properly trained, and that their laser installations comply with the goals and requirements of this guide.

4.2 Laser Users

Each laser user is responsible for the safe operation of his/her laser. This includes being aware of the position and termination of all beams and reflections, using appropriate entryway controls, and using appropriate eye protection.

Laser users shall not bypass or defeat entryway safety features, barriers, or interlocks. Doing so is a serious safety violation and may lead to loss of laser use privileges.

4.3 Laser Safety Officer

The LSO is responsible for assuring that laser hazards are evaluated and appropriate safety measures are implemented by the PI and users. The LSO will assist with laser safety training, the selection of eye protection, and inspecting laser use areas and equipment.

5 Regulation and Standards

5.1 ANSI Z136

The American National Standards Institute publishes the ANSI Z136 set of documents representing a consensus standard for laser safety. The standard is based on the goal that the level of safety control matches the hazard present. Cornell primarily follows ANSI Z136.1 (2014) - *Safe Use of Lasers* and ANSI Z136.8 (2012) - *Safe Use of Lasers in Research, Development, or Testing*, but other volumes may also apply in specific situations.

The full set of ANSI Z136 volumes includes:

- ANSI Z136.1 (2014) - *Safe Use of Lasers*
- ANSI Z136.2 (2012) - *Safe Use of Optical Fiber Communication Systems Utilizing Laser Diode and LED Sources*
- ANSI Z136.3 (2011) - *Safe Use of Lasers in Health Care*
- ANSI Z136.5 (2009) - *Safe Use Of Lasers In Educational Institutions*
- ANSI Z136.6 (2015) - *Safe Use Of Lasers Outdoors*
- ANSI Z136.8 (2012) - *Safe Use of Lasers in Research, Development, or Testing*
- ANSI Z136.9 - *Safe Use Of Lasers In Manufacturing Environments*

5.2 FDA CDRH Federal Regulations

The Center for Devices and Radiological Health (CDRH), which is part of the Food and Drug Administration (FDA) at the federal government level, regulates laser products marketed in the United States. All laser and laser equipment marketed is required to meet the minimum safety requirements found in 21 CFR 1040.10.
The CDRH requirements apply to anyone who builds a laser or laser equipment, or modifies equipment, and provides the equipment to a third party. Lasers or equipment built or modified by a person for their own use is exempt from the CDRH requirements.

Contact the LSO for more information if you will build or modify lasers or laser equipment for someone else.

5.3 New York Department of Labor Code Rule 50
New York is one of few states with a laser safety regulations, specified in Code Rule 50. These regulations include:

- Employers shall not permit an individual to be exposed to laser radiation above maximum permissible levels without the person using personal protective equipment.
- Every employee shall use protective equipment provided for his or her use.
- Protective eyewear shall be used by all persons when laser use conditions could lead to an accidental exposure above the maximum permissible exposure limit.
- Safety eyewear shall be inspected once every six months to ensure the optical density is appropriate for the laser in use and confirm there are no optical defects.

6 General Safety Performance Standards

6.1 For All Laser Classes
The purpose of control measures is to reduce the possibility of eye and skin exposure to hazardous levels of laser radiation and associated hazards.

Engineering control measures shall be given primary consideration when developing a laser hazard control program. Table 1 shows the ANSI requirements for laser hazard controls. Procedural or administrative control measures may be utilized when engineering controls are impractical or inappropriate and the PI / supervisor and LSO agree that an equivalent level of protection is obtained. When multiple class lasers are in use, or will be used, the highest laser class will determine the level of safety to be implemented.
### Table 1: Engineering control measures for the seven laser classes (reproduced from ANSI Z136.1-2014 Table 10)

<table>
<thead>
<tr>
<th>Engineering Control Measures</th>
<th>Laser Classification</th>
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<tr>
<td></td>
<td>1</td>
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<tr>
<td>Protective Housing</td>
<td>●</td>
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<tr>
<td>Without Protective Housing</td>
<td>LSO shall establish Alternative Controls</td>
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<td>Interlocks on Removable Protective Housings</td>
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<tr>
<td>Service Access Panel</td>
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<tr>
<td>Key Control</td>
<td>—</td>
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<tr>
<td>Viewing Windows, Display Screens, Diffuse Display Screens</td>
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<tr>
<td>Ensure viewing limited &lt; MPE</td>
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<tr>
<td>Colecting Optics</td>
<td>●</td>
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<tr>
<td>Fully Open Beam Path</td>
<td>—</td>
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<tr>
<td>Limited Open Beam Path</td>
<td>—</td>
</tr>
<tr>
<td>Enclosed Beam Path</td>
<td>Further controls not required with interlocked protective housing</td>
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<tr>
<td>Area Warning Device</td>
<td>—</td>
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<tr>
<td>Laser Radiation Emission Warning</td>
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<tr>
<td>Class 4 Controlled Area</td>
<td>—</td>
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<td>Entryway Controls</td>
<td>—</td>
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<td>Protective Barriers and Curtains</td>
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<td>Administrative and Procedural Control Measures</td>
<td></td>
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<tr>
<td>Measures</td>
<td>1</td>
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<tr>
<td>Standard Operating Procedures</td>
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<td>Output Emission Limitations</td>
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<td>Outdoor Control Measures</td>
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<td>Laser in Navigable Airspace</td>
<td>○</td>
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<tr>
<td>Alignment Procedures</td>
<td>●</td>
</tr>
<tr>
<td>Spectators</td>
<td>◽</td>
</tr>
<tr>
<td>Service Personnel</td>
<td>LSO Determination</td>
</tr>
</tbody>
</table>

**Legend:**
- **●** Shall
- **◼** Shall if enclosed Class 3B or Class 4
- **◎** Should
- **△** May apply with use of optical aids
- **MPE** Shall if MPE is exceeded
- **NHZ** Nominal Hazard Zone analysis required
- **—** No requirement
6.2 Temporary Higher-Class Laser Use Areas
When an operation creates a temporary high class area (e.g. removing the enclosure of Class 1 laser equipment to access the Class 4 laser inside for maintenance), control measures for the higher class laser will be temporarily implemented. When a temporary area is created, the warning signs posted may need to be changed to reflect the new hazard level. Contact the LSO to discuss temporary laser areas.

6.3 Beam Control
No laser beam, regardless of class, may intentionally leave the NHZ unless approved by the LSO. This includes fiber optic transmission between labs and wall and floor penetrations.

Precautions shall be taken to consider unintended reflections and prevent them from leaving the NHZ. Proper placement and orientation of the laser and optical path can contribute significantly to meeting this performance standard.

Where possible, use of fiber optics is high recommended. Once the beam is contained in a fiber, the laser hazard is greatly reduced.

6.4 Designing Laser Labs and Use Areas
Laser safety considerations must be included early in the design of new labs or use areas. Section 8 provides safety performance standards, by laser class, to be included in the design, layout, and construction of any laser lab or use area. Please contact the LSO at radiation-safety@cornell.edu to plan and review the design of labs or use areas.

Some general considerations include:

- Keep laser use to the rear of rooms whenever possible.
- Keep laser beams and optical paths pointing away from doors or the entrance to the NHZ. Windows should be blocked.
- Keep beam paths above or below eye level.
- Use of barriers, shields, or enclosures close to the beam or optical path provides the best protection.
- Consider how an unauthorized would safely gain access to the room in the event of an after-hours emergency like a fire or flood. Interlock systems are readily available and can shut down a laser system either when the door is breached, or with an emergency kill switch.
Figure 2: Minimum clearances

Figure 3: Entryway protection for a Class 3B system. The room is designed so multiple reflections would be required to escape the room. Curtain is fixed.

PPE Storage
7 Laser Safety Curtains

Laser curtains are a type of protective barrier used in conjunction with Class 3B and Class 4 lasers to prevent direct and diffusely scattered laser radiation in excess of the maximum permissible exposure (MPE) limits from exiting into other areas [1]. A barrier may be used at
the entrance way to a dedicated laser laboratory, to cover windows, as a perimeter guard around all or part of an optical table, or during laser servicing and alignment.

Class 3B and 4 lasers are considered high power lasers and represent both an eye and skin hazard. Laser curtains provide protection by preventing the laser radiation from exiting the laser control area. Thus, they are intended to protect persons outside the laser control area from accidental exposure. Laser curtains are not intended to serve as long-term beam blocks – they are rated by their ability withstand short term (i.e. 100 sec) exposures. Examples of blocks whose purpose is to terminate the beam within the laser control area for more than an incidental period of time are beam dumps, beam blocks and beam traps.

The effectiveness of a laser curtain is a function of its ability to withstand damaging radiant exposures. This is evaluated by determining the burn-through time (penetration threshold level or PTL), which is a function of the incident power, material thickness and material type [1]. In addition and related, the laser curtain material must be fire-resistant. Class 4 lasers beams can result in potential fire hazards if materials are exposed to irradiances exceeding 10 W/cm² or beam powers exceeding 0.5 W [2, 3]. Under some situations where flammable compounds or substances exist it is possible that fires can be initiated by Class 3B lasers [2, 4]. The Fire Code of New York State [5] specifies that all curtains hung in laboratories must meet the flame propagation performance criteria of NFPA 701 [6] or be noncombustible.

The standard ANSI Z136.7 American National Standard for Testing and Labeling of Laser Protective Equipment provides recommendations to the manufacturer for testing and labeling of laser curtains [1]. The testing protocol is based on the ability of a barrier to withstand beam penetration when exposed for 100 seconds at a maximum incident irradiance level. In addition, laser barriers should not support combustion or release laser gas air contaminants (LGAC) following an exposure. Barriers are tested over a range of beam diameters (3-10 mm) under standardized conditions. Evaluation is based on first appearance visible damage, power level at which beam breakthrough of the material occurs (penetration threshold level or PTL), and analysis of laser generated air contaminants (LGAC) if flame and thermal distortion or air contamination are observed.

ANSI Z136.7-2008 specifies the minimum information to be provided on the barrier label by the manufacturer as 1) the threshold limit and exposure time for which the limit applies and the exposure conditions under which protection is afforded and 2) manufacturer and model number or barrier material [1]. The barrier should be accompanied by information on intended use, exposure limitations, conditions for which protection is specified, and cleaning, storage and inspection instructions.
7.1 Purchasing Considerations

Commercial laser curtains are typically purchased prefabricated. In-house altering of the curtains or accompanying assembly may have a negative effect on its protective properties. It is uncommon for laser curtain suppliers to sell bulk fabric.

EHS, along with the laser curtain supplier selected, can assist laboratories in choosing appropriate curtains, configurations, and hardware, based on the characteristics of the laser and layout of the room.

The following information should be considered:

a) The dimensions of the area that needs to be enclosed and how the curtains will be mounted (ceiling hung, free standing, etc.). Grommets and other hardware should be made of non-reflective and non-flammable materials.

Curtains should be hung 18 inches below the ceiling when the room has sprinklers and 24 inches when no sprinklers are present. Curtains should not be hung from ceiling to floor unless it is required for the lighting conditions of the application. The Cornell University Fire Marshal’s Office should be consulted if ceiling hung curtains are desired to determine the impact on the fire protection systems and if the installation will result in an obstruction [http://sp.ehs.cornell.edu/fps/Pages/default.aspx](http://sp.ehs.cornell.edu/fps/Pages/default.aspx).

b) The type of closer to be used and if interlocks are needed. When curtains are used as entryway protection and a split is present, the curtain parts should overlap each other by at least 6 inches (15 cm).

Operations should be conducted such that no radiation above the MPE occurs outside the nominal hazard zone.

c) The appropriate threshold limit (e.g. 100 W/cm², 250 W/cm², etc.) is based on the laser characteristics. Typically, the laser curtain supplier calculates this limit using the laser specifications provided by the purchaser.

7.2 Documentation

Regardless of which laser supplier is chosen, the curtains should have the following documentation and labeling (provided by the supplier):

a) Documentation that the materials were tested according to ANSI Z136.7 and that the PTL (sometimes just abbreviated TL) is appropriate for the proposed laser use.

*Note: The adequacy of protection (PTL) must be re-confirmed if laser hazards change in the area, for example adding new lasers with different properties.*
b) Labeled according to ANSI Z136.7.

c) Instructions on cleaning, storage and inspection.

d) Documentation affirming that the curtain material meets the flame-resistant performance criteria of NFPA 701 or is noncombustible.

All documentation should be obtained, retained on site and made available to EHS or the University Fire Marshal’s Office upon the request.

7.3 Blackout Curtains

The purpose of blackout curtains is to exclude light from an area. **Blackout curtains do not provide protection from laser hazards.** In addition to research laboratories, they are used in a variety of applications such as in theatre, photography and hotels. There is no standard definition of a blackout curtain and not all commercial blackout curtains block 100% of the light.

In laser applications, blackout curtains are generally used to block room light from interfering with the experiment or measurement. Laser curtains can be used as blackout curtains (in addition to serving as protective barriers), but blackout curtains that are not certified as providing laser protection are not laser curtains.

Blackout curtains may be used in conjunction with non-laser light and Class 1-3R lasers. Class 1-3R lasers do not represent an ignition hazard and ANSI Z136.1 does not require the use of laser rated protective barriers for these classes [2].

As with laser curtains, blackout curtains hung in laboratories must meet the flame propagation performance criteria of NFPA 701 or be noncombustible [5, 6]. EHS strongly recommends that any blackout curtains purchased be NFPA certified as flame resistant for the life of the product (inherently or durably inflammable material) rather than made from material treated with a fire retardant. The flame-resistance of treated fabric may decrease over time and with washing, and fire-resistant certification is typically limited (e.g. 1-5 years). The University Fire Marshal will require curtains that are not NFPA 701 certified, that have a limited certification, or where the certification life-span is unknown, to be tested or retested at the owner’s expense. Be sure and retain any certification documentation to provide to the University Fire Marshal’s Office.

7.3.1 Documentation

There are a wide variety of blackout curtain suppliers. Regardless of which blackout curtain supplier is chosen, the curtains should have the following documentation (provided by the supplier):

a) Documentation of flame resistant, certified to meet NFPA 701 and accompanied by a statement from the manufacturer as to the duration of the flame resistant. Blackout
curtains that are certified for the life of the product are strongly recommended (IFR, Inherently Flame Retardant)

The documentation should be obtained, retained onsite and made available to the University Fire Marshal’s Office upon request. The University Fire Marshal will require blackout curtains that are not NFPA 701 certified, have a limited certification, or whose certification life-span is unknown to be tested or retested at the owner’s expense.

b) Accompanied by instructions on cleaning, storage and inspection.

8 Training
The level of training shall be appropriate to the level of the laser hazard being used. EHS provides general laser safety training via CULearn, which must be supplemented by specific in-lab training by the PI / supervisor or experienced user approved to provide training.

- Class 1 and 2 – training not required
- Class 1M and 2M – application dependent, contact the LSO
- Class 3R (and 3a) – training recommended for use of alignment lasers
- Class 3B and 4 – training required

Refresher training is required every three years.

8.1 Use of Lasers by Construction, Shops and Surveying Personnel
Use of lasers is regulated by OSHA and requires laser safety training. The LSO will provide this training upon request. Contact the LSO at radiation-safety@cornell.edu for more information.

9 Medical Examinations
9.1 Preassignment Medical Exams
Baseline eye exams may be considered for those working with Class 3b and Class 4 lasers. If a potential user has a medical issue (e.g. prior laser eye injury, pre-existing medical condition, medication that enhances photosensitization) that would make them more susceptible to laser radiation, this should be discussed with the LSO to determine the appropriate course of action. The LSO may recommend preassignment and termination medical examinations in some circumstances.

9.2 Accidents and Exposures
In the event of an actual or suspected injury, a medical exam should be performed as soon as practical, ideally within 24 hours. Suspected retinal damage should be inspected by an ophthalmologist. If necessary, contact the LSO at radiation-safety@cornell.edu for guidance on seeking medical attention.
Actual or suspected injuries and near misses should be reported to the supervisor and the Cornell University Injury/Illness/Exposure Reporting website as soon as practical, ideally within 24 hours.

10 Class-Specific Laser Safety Performance Standards

10.1 Class 1 Lasers and Laser Equipment
Class 1 lasers are safe under all conditions of normal use. The laser radiation is typically enclosed (e.g. a laser printer).

There are no laser safety requirements for this class. However, Class 1 equipment typically has higher class lasers inside. Removing access panels and enclosures may create an NHZ outside the equipment which will require high class control measures.

10.2 Class 1M, 2, 2M, and 3R Lasers and Equipment
These lasers represent a minimal hazard due to the potential to exceed the MPE under special circumstances:

- Classes 1M and 2M: Safe unless viewing with magnifying optics such as microscopes and telescopes
- Class 2: Safe unless the blink reflex is intentionally suppressed
- Class 3R (and 3a under the old classification system): Safe if handled carefully with restricted beam viewing. A Caution area sign should be posted (except in the case of laser pointers). Eye protection may be recommended for alignment lasers.

Windows should be covered with laser opaque material and keep lab doors should be kept closed when lasers are operating. Laser opaque material can be filter material of the appropriate OD.

10.3 Class 3B Lasers and Equipment
Lasers in this class are capable of causing accidental eye and skin injury with direct exposures, but not with diffuse reflections.

- Warning signs are required at the entrance to the NHZ. The LSO can provide signs with the proper wording.
- A controlled area and some form of entryway protection (e.g. barriers or curtains, interlocked doors, locked doors) is generally required. Contact the LSO to make this determination.
- If entryway protection is not used, doors shall be closed when the laser is operating.
- Windows shall be covered with laser opaque material.
- For shared laser and non-laser use spaces, the area shall be arranged so that non-laser users do not have to pass through a laser area to reach their work area.
- The laser work area shall be managed to ensure unintended specular reflections are eliminated.
• Eye protection is required.
• Written alignment procedures are required. Written standard operating procedures are strongly recommended.

10.4 Class 4 Lasers and Equipment
Class 4 lasers are the most dangerous class of laser. Such lasers are capable of burning the skin, and can cause ruinous damage to the eyes as the result of direct, indirect, or diffuse beam viewing. Class 4 lasers present fire hazards, and may also present other non-beam hazards like electrical or chemical hazards.

• Warning signs are required at the entrance to the NHZ. The Danger signal word is only used for Class 4 lasers with multi-kilowatt exposed beams that could result in serious injury or death.
• Class 4 lasers require controlled area with entryway protection (e.g. laser curtains and/or interlocked doors).
• Entryway protection shall be designed to prevent a single diffuse bounce or reflection from reaching public or non-laser areas.
• Entryway protection shall be designed to allow enough room for people entering to put on eye protection before entering the laser use area.
• The entryway protection is required to be in place before the laser is allowed to operate. Class 4 lasers have an electrical interlock connection that may be connected to the entryway protection for this purpose. For example, if a curtain is used around a laser setup, an interlock switch is required on the curtain if the curtain is movable in its track. This ensures that the curtain is fully closed before laser operation is enabled. A curtain interlock is not required if the curtain is fixed in place.
• When curtains are used as entryway protection and a split is present, the curtain parts must overlap each other by at least 6 inches (15 cm).
• A laser warning light is required at the entrance to the NHZ. If possible, an automatic light is strongly recommended so the light is turned on or off when the laser is on or off. The LSO can provide recommendation for suppliers of laser lights. If the light is manually controlled, the light switch shall be located near the laser controls. The light shall be located as close to general eye level as possible (e.g. about 60 inches or 152 cm above the floor) to the side of the entryway.
• Emergency shut off switches may be required at strategic locations, e.g. to provide emergency responders access to the NHZ in the event of a fire or flood. The LSO will assist in making this determination.
• For shared laser and non-laser use spaces, the area shall be arranged so that non-laser users do not have to pass through a laser area to reach their work area.
• The laser work area shall be managed to ensure unintended specular reflections are eliminated.
• Eye protection is required when the beam is not fully enclosed or contained.
• Written alignment and operating procedures are required.
To prevent unauthorized use, entrances to laser labs or areas should be locked when not occupied for extended periods of time.

10.4.1 Special Class 4 Considerations
Because Class 4 lasers represent a fire hazard, the ignition potential of any materials in the NHZ that could be exposed to the beam must be considered.

Class 4 lasers can interact with gases and materials that are part of the experiment, causing reactions or decomposition that introduce unintended toxic or carcinogenic exposure hazards. Contact the LSO at radiation-safety@cornell.edu to discuss whether additional controls, such as local ventilation, may be required.

Excimer lasers commonly use compressed corrosive and/or toxic gases. Anyone handling or using compressed gases must take compressed gas safety training at CULearn, and must have hands-on training. General guidance on compressed gas safety is covered in the Cornell Laboratory Safety Manual and Chemical Hygiene Plan.

11 Personal Protection Standards

11.1 Eye Protection
Eye protection is most important for Class 3b and Class 4 lasers. Eye protection with low OD may be desired for the lower classes when they are in a fixed position, for example Class 3R alignment lasers. The LSO will assist with eyewear selection.

Note that eye protection is generally not designed to withstand the direct hit of a high powered Class 4 beam. Pulsed lasers can have extremely high peak powers and cause instant eyewear failure. Engineering controls are the first line of defense, personal protective equipment is a protection of last resort. Users must take precautions to prevent direct beam exposures.

Recent studies have shown that the optical density of protective eyewear is lower than advertised for ultrafast lasers (especially, for example, pulses < 100 fs). These concerns have not yet been addressed by the ANSI standards used in the US. However, the European standard EN207 does include specifications.

11.2 Skin Protection
For UV lasers, skin exposure is a concern for sun burn like effects and an increased risk of skin cancer. When UV scatter cannot be reduced by shielding, other forms of skin protection must be used. Chemical face shields can block all scattered mid to far UV while lab coats and gloves can reduce exposure to the rest of the body.
12 Laser Use Outdoors
Because of Federal Aviation Administration (FAA) and New York State regulations, laser use outdoor is not permitted at any time unless approved by the LSO. The LSO will coordinate notification to the FAA and NY to obtain the required approvals.

Note: this does not include the use of lasers by construction, maintenance, surveying, or shops personnel who are covered under OSHA.

13 Related Hazards
13.1 Electrical
The only known laser-related fatalities have been due to electrical accidents. Nearly all lasers that use wall-supplied AC power have high-voltage hazards inside. Battery powered lasers do not generally have high-voltage concerns, but this is not always the case. Follow basic electrical safety practices. Basic electrical safety training is available via CULearn.

13.2 Chemical
Dye lasers use fluorescent organic dyes to obtain tunable beams. The dyes vary widely in toxicity and are sometimes dissolved in hazardous solvents. Be sure to review the Safety Data Sheet (SDS) for the dye and solvent before handling these chemicals. In some cases use in a fume hood or other ventilation may be required.

Some optical components are made of hazardous materials. Some examples are calcium telluride, zinc telluride, cadmium oxide, and beryllium. If irradiance limits are exceeded these may decompose.

13.3 Explosion
If optical components are not kept clean or if irradiance limits are exceeded, these may explode creating a flying object hazard. Be sure to inspect optics regularly and replace any components that are suspect or visibly damaged.

14 Transfer or Disposal of Lasers
14.1 Transfer
Because some lasers utilize hazardous materials, transfer of lasers to others outside of Cornell may require the laser be decontaminated prior to shipment. Contact the LSO for more information.

14.2 Disposal
New York State requires that all lasers for disposal must be made inoperable. Acceptable methods include:
• Cutting off power cords
• Breaking laser tubes (using proper safety and exhaust precautions)
• Disconnecting and separating power supplies from laser head or modules.

Hazards from dye, chemicals, and gases must be removed before disposing or recycling equipment.

Contact radiation-safety@cornell.edu for guidance on disposal of laser equipment.