UCLA ENVIRONMENT, HEALTH & SAFETY

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Laser Safety

LASER LITE; A Quick Overview of Laser Safety 06/09

THE PRIMARY PURPOSE OF THE UCLA LASER SAFETY PROGRAM IS TO

AVOID GETTING A LASER BEAM IN YOUR EYE

NEVER STARE DIRECTLY AT A LASER BEAM, EVEN WITH PROTECTIVE EYEWEAR

LASER LIGHT
- *Maintains strength over long distances*
- *Produces significant eye hazards at relatively low levels*
- *Concentrates to a very high intensity when focused by a lens*
- *Occurs in the Visible and Non-visible spectrum*

BIOLOGICAL HAZARDS
- *Can be laser beam and non-beam related*
- *Can occur at all wavelengths*
- *Occur mainly in the eyes and skin*

MOST INJURIES
- *Affect the eyes*
- *Occur during alignment*
- *Result from operator error*

PROTECTION
- *Eyewear must be worn for Class 3B and Class 4 laser use*
- *Eyewear must meet ANSI standards and be marked with Optical Density and Wavelength*
- *Appropriate skin protection is required for Class 4 lasers*

LASER CLASSIFICATION TABLE

Class 1 / 1M	**Maximum power output is a few microwatts. Visible spectrum output** Considered incapable of producing hazardous eye/skin exposure unless viewed with collecting optics (1M). Does not apply to open Class 1 enclosures containing higher-class lasers
Class 2 / 2M	**Maximum power output is < 1 mW. Visible spectrum output** Considered incapable of producing hazardous eye/skin exposure within the time period of human eye aversion response (0.25 s).unless viewed with collecting optics (2M)
Class 3R	**Maximum power output is 1 mW - < 5 mW. Visible and non-visible spectrum** Potentially hazardous under some direct and specular reflection viewing condition if the eye is appropriately focused and stable or if viewed with collecting optics.
Class 3B	**Maximum power output is 5 mW - < 500 mW Visible and non-visible spectrum** Presents a potential eye hazard for intrabeam (direct) or specular (mirror-like) conditions. Presents a significant skin hazard by long-term diffuse (scatter) exposure if higher powered and operating in 200 – 280 nm UVC ranges
Class 4	**Maximum power output is > 500 mW. Visible and non-visible spectrum** Presents potential acute hazards to the eye and skin for all intrabeam and diffused conditions Potential hazard for fire (ignition), explosion and emissions from target or process materials.

EYE DAMAGE - WAVELENGTHS

WAVELENGTH	AREA OF DAMAGE	PATHOLOGICAL EFFECT
180 - 315 nm (Ultraviolet UV-B, UVC)	**CORNEA**; Deep-ultraviolet light causes accumulating damage, even at very low power	**Photokeratitis;** Inflammation of the cornea, similar to sunburn
315 - 400 nm (Ultraviolet UV-A)	**CORNEA and LENS**	**Photochemical cataract;** Clouding of the lens
400 - 780 nm (Visible)	**RETINA;** Visible light is focused on the retina	**Photochemical damage;** Damage to retina and retinal burns
780 - 1400 nm (Near Infrared)	**RETINA;** Near IR light is not absorbed by iris and is focused on the retina	**Thermal damage to cataract** and retinal burns
1400 - 3000 nm (Infrared)	**CORNEA and LENS; I**R light is absorbed by transparent parts of eye before reaching the retina	**Aqueous flare;** Protein in aqueous humor, cataract, corneal burn
3000 – 10000 nm (Far Infrared)	**CORNEA**	**Corneal burn**

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LASER OPERATION GUIDELINES

OPERATORS MUST;

- Review **Standard Operating Procedures**, operating and safety instructions and laboratory-specific laser instructions
- **Be trained in laser safety** and specific laser procedures
- **Observe all written procedures, safety rules** and **properly use appropriate PPE**
- Be **authorized by the Principal Investigator**
- Be **directly supervised** by a person knowledgeable in laser safety
- **Wear appropriate PPE**, follow safety procedures and SOP's
- Never circumvent **Administrative or Engineering safety controls**
- Know the location and use of the **power kill switch and fire extinguisher**
- Use the buddy system when working with **high voltage equipment**
- **Not wear reflective metal jewelry** when working with laser beams
- **Never stare directly into a beam** even with eye protection; use indirect viewing
- Give sufficient attention to **non-beam hazards** to prevent possible injury and illness
- Be aware of **plasma and collateral radiation**
- **Notify supervisor immediately** of potentially hazardous conditions, personal injury, or property damage

IN EACH LAB, PERSONNEL MUST BE ABLE TO OBTAIN:

- **Training** on equipment, procedures and emergency procedures
- **Safety Equipment** that is sufficient in numbers for lab staff, appropriate for the equipment in use and in good operating condition
- **Standard Operational Procedures** for the safe use of all equipment
- Information from the PI or Lab Manager about **potential equipment hazards**

EMERGENCY INSTRUCTIONS

1. **Shut the laser off immediately** and **remove the interlock key**. If not possible, alert everyone to **exit the laboratory** and be the last to leave the laboratory

2. If there is a fire, get everyone out of the laboratory immediately. At the same time **shout "FIRE" loudly** and frequently. **Turn on a fire alarm**. Do not try to "fight" the fire from inside the laboratory; do it from the doorway to maintain an escape route

3. In the event of MAJOR injury, **Summon Medical Assistance.** Call 911 from a campus phone or 310-825-1491 from a cell phone

4. **Call Security and/or Fire Department (911) as necessary**

5. **Call EHS Hotline (59797) to report the incident**
   Note; ALL incidents must be reported to the Laser Safety Officer

6. **Contact the PI and/or Lab Manager** and describe the emergency