

LASER SAFETY

Awareness, Refresher Course



Created from:



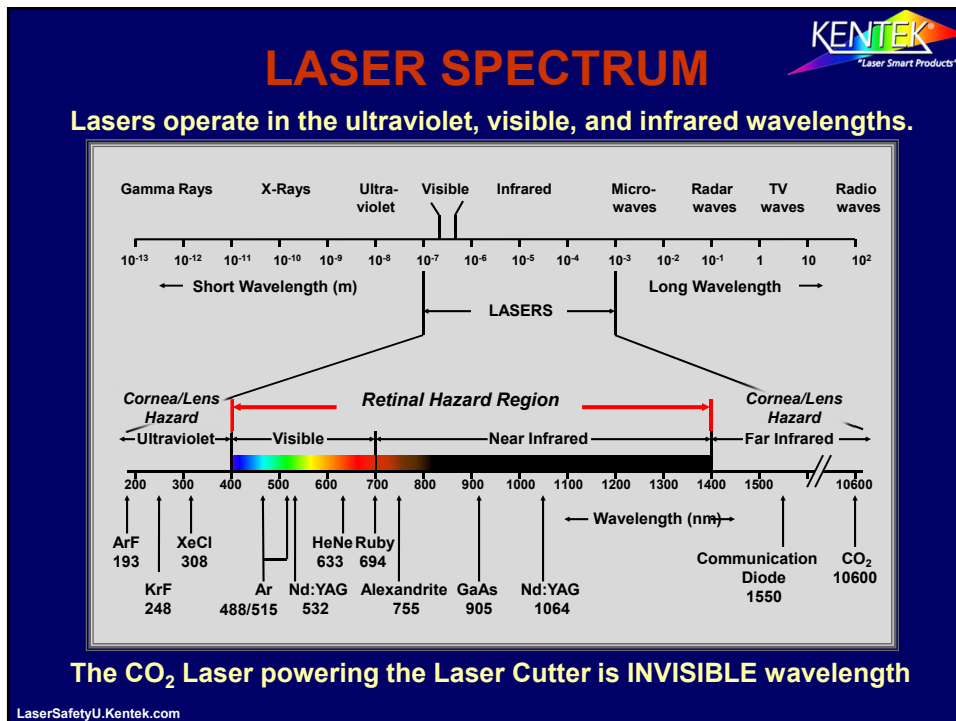
COURSE CONTENT:

- Basics of Lasers and Laser Light
- Laser Components
- Laser Hazard Classes
- Types of Lasers
- Laser Beam Injuries
- Non-Beam Hazards
- Laser Safety Standards & Control Measures
- Safe Work Practices & Beam Alignment
- Incident Reporting

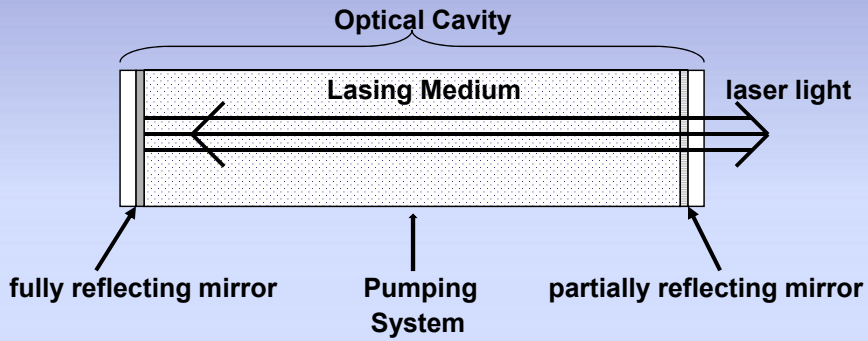
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BASICS OF LASERS AND LASER LIGHT

Light
Amplification by
Stimulated
Emission of
Radiation



Laser Basic Components



Laser light is caused by material stimulated and magnified by being reflected back and forth with mirrors in an optical cavity to get in a uniform electron excited state and then some released through small opening on one side.

5

Example: Helium-neon Gas laser tube



Courtesy of Metrologic, Inc.

6

Laser Components Summary

- Lasers Have Three Main Components
 - **Active Medium:**
 - Solid (Crystal), Gas, Semiconductor (Diode), Liquid (Dye)
 - Capable of **Stimulating Emission**
 - **Excitation Mechanism** (Energy Source)
 - **Feedback Through Optical Cavity** (Mirrors)
- Laser light has unique characteristics
 - **Monochromatic** (One Wavelength)
 - **Directional** (Low Divergence or light spread)
 - **Coherent** (Waves In Phase)

This combination causes laser light to focus to a tiny spot. The Irradiance (power) on that area can be quite intense. Reflected light can also be damaging.

7

LASER HAZARD CLASSES

Lasers are classified according to power and harm from low (1) to high (4)

Could be an Enclosed Laser

Class 1 Incapable of causing injury during normal operation

Class 1M Incapable of causing injury during normal operation unless collecting optics are used

Laser cutter due to Red diode laser for alignment

Class 2 Visible lasers incapable of causing injury in 0.25 s.

Class 2M Visible lasers incapable of causing injury in 0.25 s unless collecting optics are used

Class 3R Marginally unsafe for intrabeam viewing; up to 5 times the class 2 limit for visible lasers or 5 times the class 1 limit for invisible lasers

3B and 4 lasers are regulated and require safety controls for use, access, PPE, training, etc.

Class 3B Eye hazard for intrabeam viewing, usually not an eye hazard for diffuse viewing

Class 4 Eye and skin hazard for both direct and scattered exposure

8

CLASS 1

CLASS I Laser System or Product

- Safe during normal use
- Incapable of causing injury (with interlocks)
- Low power laser, or enclosed higher class beam



May be higher class during maintenance or service if open or access to laser

Neodymium Yag (Nd:YAG) Laser Marker

CLASS 2



Laser Scanners




- Staring into beam is an eye hazard
- Eye protected by aversion (blink) response
- Visible lasers only
- Considered safe for public use
- Maximum power 1 milliwatt (mW)
- Red alignment diode laser used in Cutter



CLASS 3R (Formerly 3a)

- Eye Aversion response may not provide eye protection
- Hazard if used with optical instruments or microscope
- CDRH includes visible lasers only
- ANSI includes invisible lasers
- Maximum power (visible) 5 mW (1-5mW)

Laser Pointers



CAUTION

Laser Radiation-
Do Not Stare Into Beam or View
Directly With Optical Instruments

Helium Neon Laser
5 milliwatt max/cw

CLASS IIIa LASER PRODUCT

DANGER

LASER RADIATION-
AVOID DIRECT EYE EXPOSURE

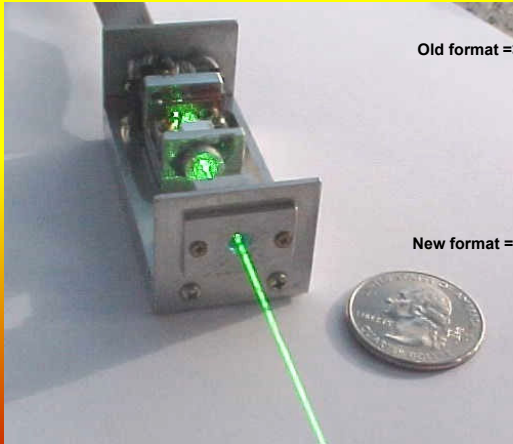
ND:YAG 532nm 11
5 milliwatts max/CW

CLASS IIIa Laser Product

CLASS 3B

- Eye hazard, minor skin hazard near upper end
- Visible or Invisible laser light beam
- Often used for research
- Maximum power 500 mW (5-500mW)

Diode, Pulsed Solid State Laser with cover removed




DANGER

LASER RADIATION-
AVOID DIRECT EXPOSURE TO BEAM

2Ø ND:YAG Wavelength: 532 nm
Output Power 80 mW

CLASS IIIb Laser Product

DANGER



Laser Radiation Class 3B.
Visible and/or Invisible
Laser Radiation.
Avoid direct eye exposure
to beam. Laser protective
eyewear required.
Diode 200mw 100-1,000nm

Courtesy of Sam's Laser FAQ, www.repairfaq.org/sam/lasersam.htm, © 1

CLASS 4

High Power Lasers

- Eye and skin hazard from beam and reflection
- Visible or Invisible light beam
- Power > 0.5 W
- Potential Fire hazard

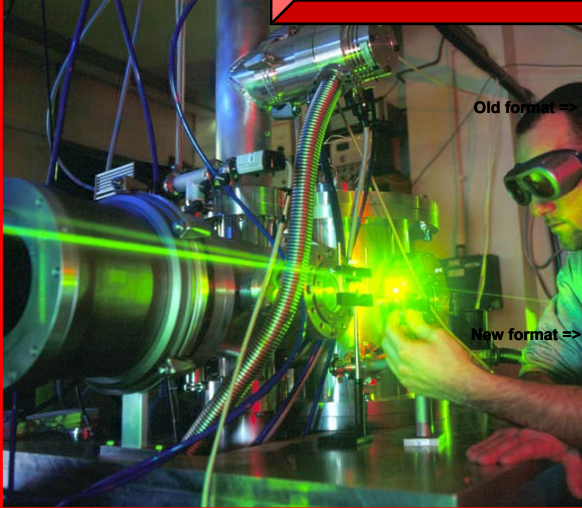



Photo: Keith Hunt, Copyright: University of Sussex, Brighton (UK)


DANGER




VISIBLE LASER RADIATION-
AVOID EYE OR SKIN EXPOSURE TO DIRECT
OR SCATTERED RADIATION

20 Nd:YAG
Wavelength: 532 nm
Output Power 20 W
CLASS IV Laser Product


! DANGER

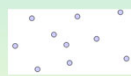



Class 4 Laser Controlled Area
Avoid eye or skin exposure to direct
or scattered radiation.
Visible and Invisible Laser Radiation.
Laser Protective Eyewear Required.
Trained Personnel Only, Knock
Before Entering.
Diode Max 550mW, 400-1000nm





TYPES OF LASERS


Solid State

Gas

Fiber

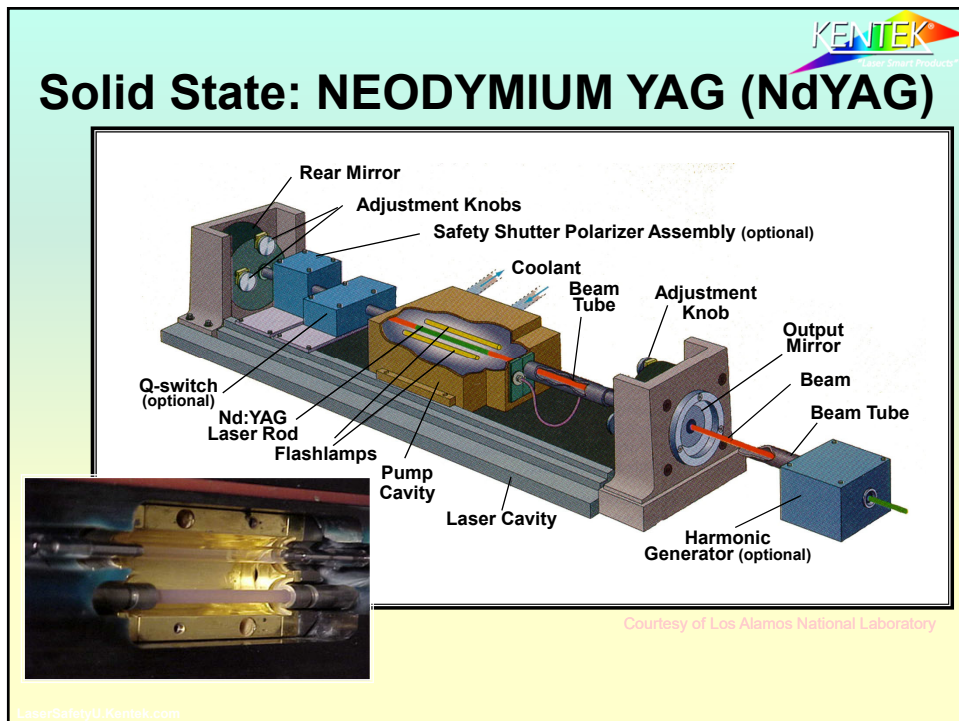
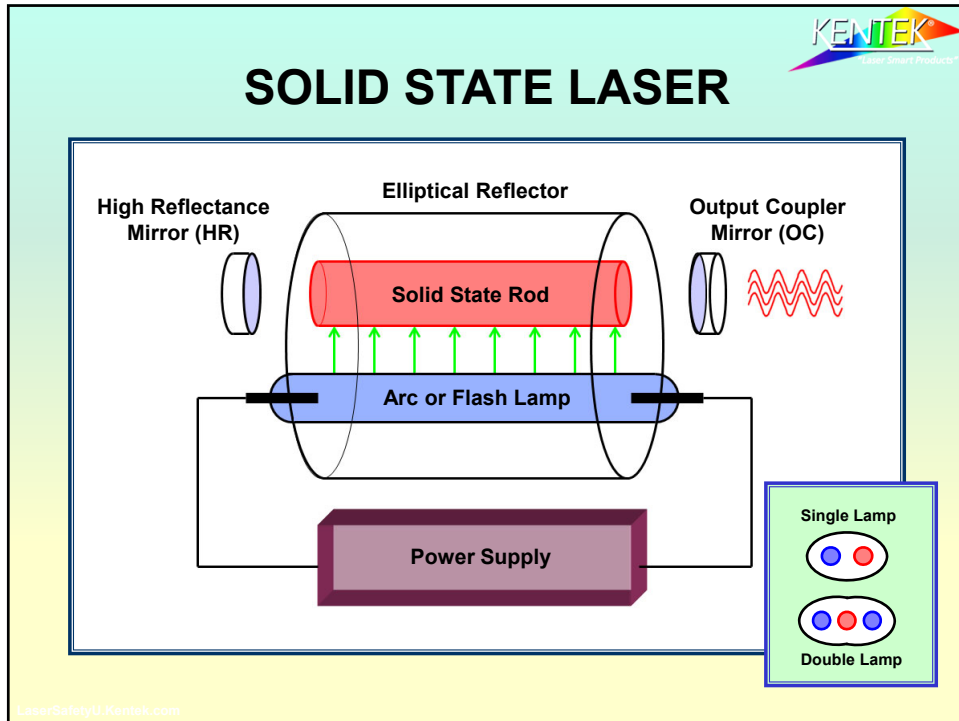
Disk

Diode

Diode Pumped Solid State

www.SafetyUKentek.com

7



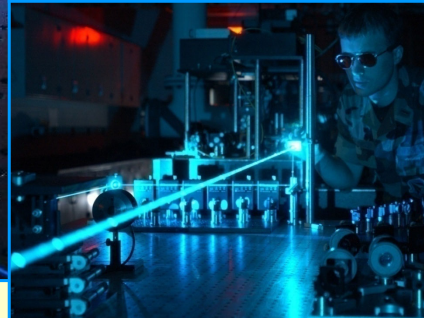
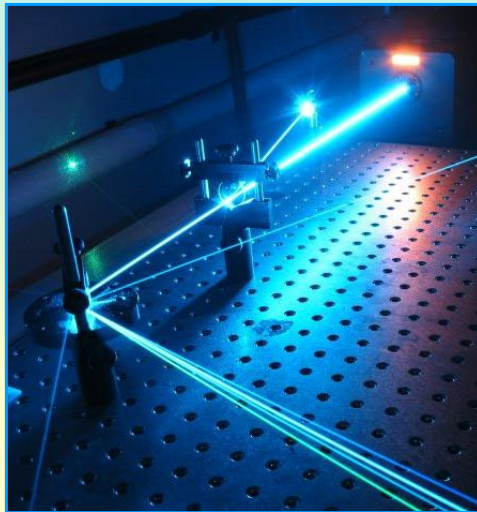


HELIUM-NEON GAS LASER TUBE

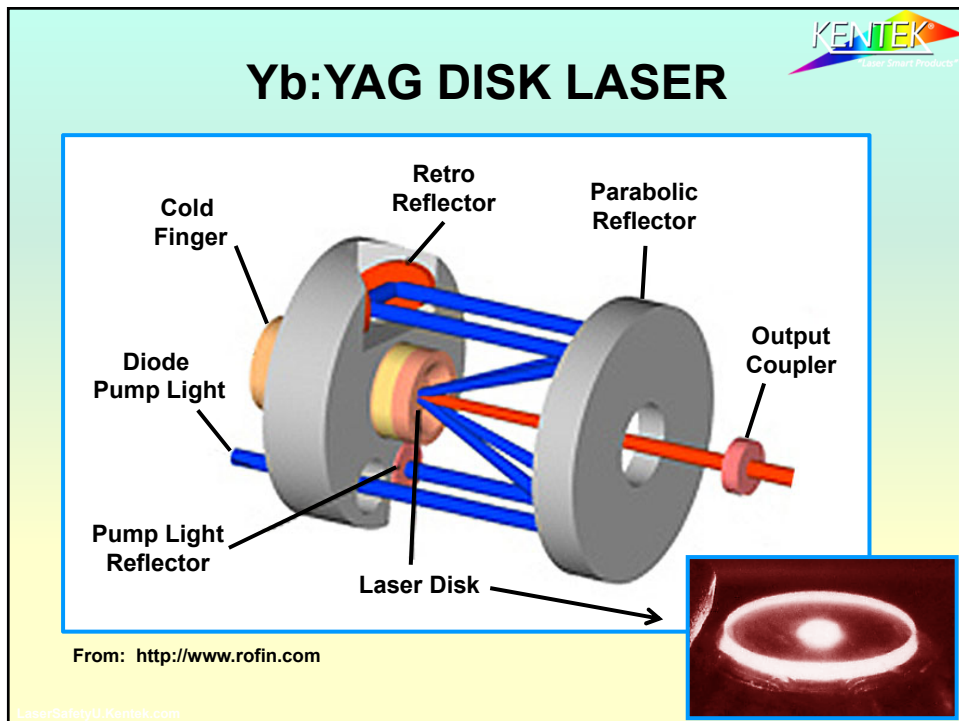
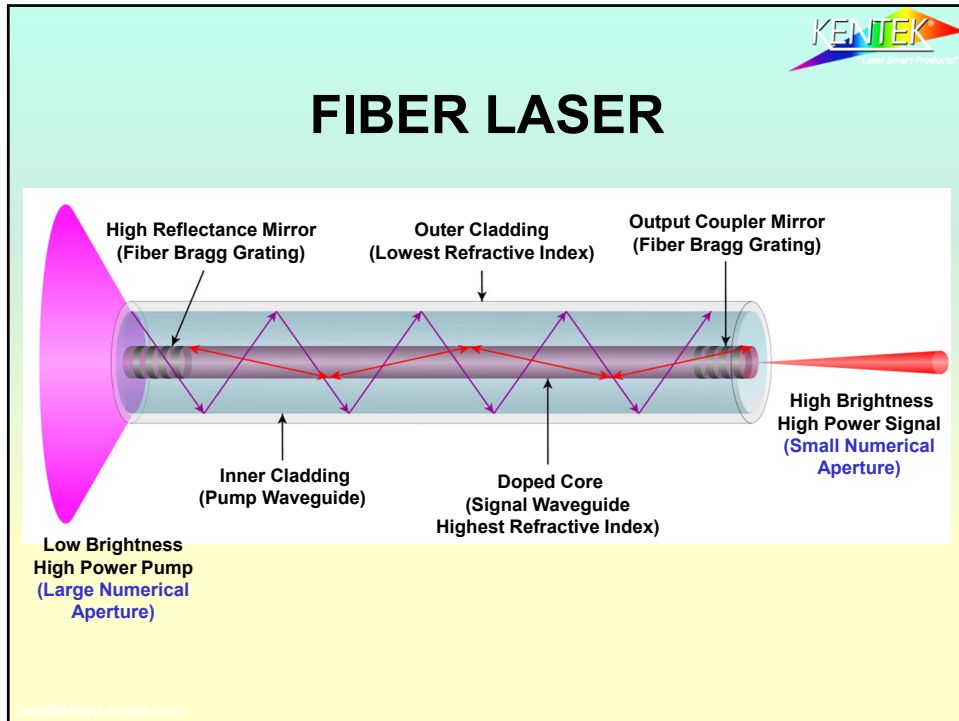


Courtesy of Metrologic, Inc.

ARGON ION GAS LASERS



www.SafetyU.Kentek.com



DIODE LASER DIAGRAM

Labels in Diagram: Metallic Contact, 10 - 20 μm , SiO₂, P-N Junction, Cleaved Facet, Current Distribution, Elliptical Beam.

Logos: KENTEK Laser Smart Products™

Source: www.kentek.com

GREEN DPSS LASER POINTER

Labels in Diagram: Battery, Pump LD Driver, DPSS Laser Module, HR@1064nm HR Mirror on HT@808nm rear surface, MCA Nd:YVO₄ KTP, OC Mirror on HR@1064nm AR@532nm front surface, LD+, LD-, Pump Laser Diode, Pump Focusing Lens, Expanding Lens, Collimating Lens, IR Filter.

Beam Paths: 808 nm — 1064+532 nm — 532 nm —

Logos: KENTEK Laser Smart Products™

Source: www.kentek.com

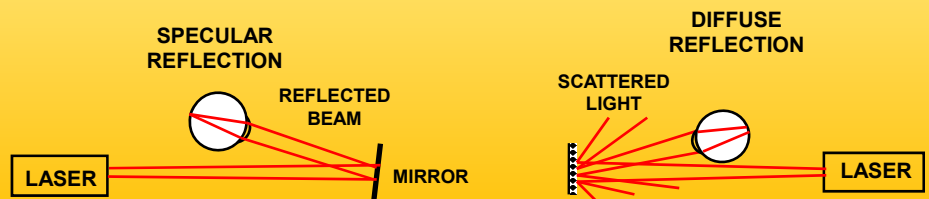
Attribution: Wikipedia image by Chris Chen

LASER BEAM INJURIES

Lasers can cause severe eye injuries resulting in permanent vision loss.

High powered lasers (Class 4) can cause skin burns, or penetrate through skin depending on the power laser.

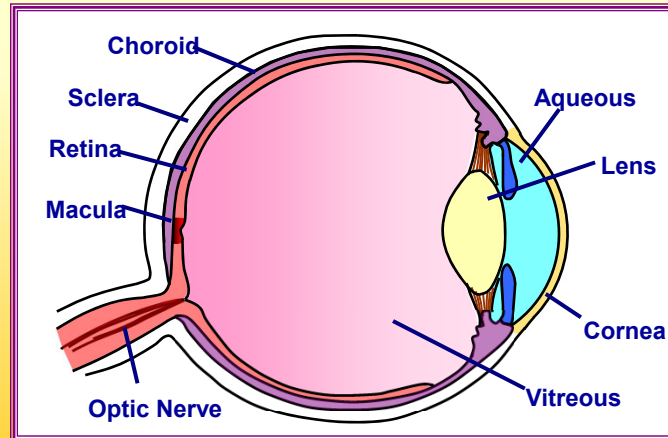
Reflections can also cause damage, depending on the power and reflection level of the surface



Laser Eye and Skin Injuries

- **Thermal Burns**
 - Caused by elevated temperature after absorption of laser energy to eyes and skin
 - Applies to all wavelengths
 - Most laser skin injuries
 - Usually not serious unless a very high power laser strikes the skin directly
- **Photochemical Burns (usually < 600 nm)**
 - Chemical reactions in tissue from energy high enough to break molecular bonds
 - Most readily with UV light, blue light

HUMAN EYE



In most cases people do not realize they are being exposed to eye injury from an invisible laser, until their vision has been severely and permanently affected.

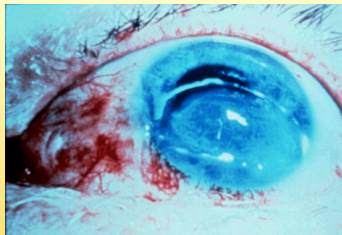
The wavelength of the laser determines which part of the eye is affected.

Lower and upper laser wavelengths affect the outer cornea, as well as the lens.

Wavelengths 400 – 1400 can enter the eye and affect the retina, where eyesight occurs. ²⁵

Cornea and Lens Hazard

$\lambda < 400, > 1400$, or high power



Superficial Injury

- Outer Corneal Epithelium layer renews itself continuously
- Lesion clears within 24 hours to 48 hours

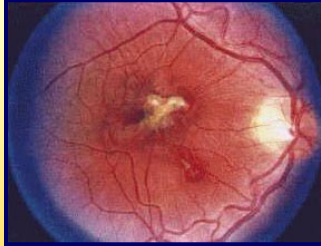
Deep Burns

- Penetrating burns produce a permanent damage
- Cornea transplant for repair may be required

26

RETINA HAZARDS

λ 400 – 1400 nm



Q-SWITCHED LASER (left)

- Retinal Injury produced by four pulses from a Nd:YAG laser range finder.
- Pulse duration 20 ns with pulse energy 15 mJ.
- The safe exposure limit for this pulse duration is 2 mJ per pulse

Invisible, Repetitive Pulse (right)

- Near infrared laser with invisible beam. In such cases people do not usually realize they are being exposed until their vision has been severely affected. The person's eye was moving during this exposure.

SKIN BURN FROM CO₂ LASER EXPOSURE

Accidental exposure to partial reflection of 2000 W CO₂ laser beam from metal surface during cutting



This injury was caused by a partial reflection of a 2,000 W CO₂ laser beam during service of a flat bed metal cutter. The beam passed through the metal plate being cut and struck an angled metal surface below the plate. A side shield had been removed during service allowing the reflected beam to escape the enclosure. The estimated exposure was about 1000 watts for a half second. This resulted in a third degree burn that was quite painful and required several weeks to heal. There was no long term loss of function of the thumb. **Our laser cutter is 50 watts.**

28

NON-BEAM HAZARDS

- Mechanical Hazards
- Smoke & Fumes from obliterated materials and surface coatings
- Process Radiation light generated during cutting
- Electrical Hazards
- Fire & Combustion Hazard
- Compressed Gases

29

LASER GENERATED AIR CONTAMINANTS



LGAC's are a common problem with all material processing lasers.

Most of the material vaporized by lasers during metal processing forms particles less than a micron in size. Breathing these particles is a respiratory hazard, even if they are not composed of hazardous substances. Processing non-metals usually produces hazardous chemical vapors. Vaporizing wood produces benzene. Vaporizing plastics can produce many carcinogens. Acrylic produces Carbon Oxides. Glass may release respirable Silica. Some materials continue emitting fumes for several minutes after laser engraving or cutting. Ensure proper ventilation.

30

LASER PROCESS RADIATION



**Laser welding and cutting
Blue Light Hazard**

**Anticipate cutting acrylic,
glass, or wood, not metal**

**Do Not stare at light that may
be generated as a result of
the cutting process**

Photo courtesy of Trumpf Inc.

Laser welding often produces hazardous process radiation. Some of the metal is vaporized, and the metal vapor rises into the path of the laser beam, absorbing some of the laser light and heating it to thousands of degrees. The resulting plasma glows brightly in the visible and ultraviolet, producing two types of ocular hazards: 1) Exposure to the ultraviolet light can result in welders flash, which is damage to cornea, may need medical attention, eye rest. 2) Staring at the visible light for even a few seconds can result in a blue light retinal injury, where the retina never recovers.

If a bright blue or white light source cannot be viewed comfortably, it should not be viewed without protective eyewear. Orange eyewear will remove the hazardous blue wavelengths and allow the process to be viewed safely. Orange argon laser eyewear is often used to view laser welding processes. Special eyewear that will block both the laser light and the blue light is available. 21

COMPRESSED GASES

- Gas Cylinders must be properly secured to a bracket with a chain or strap. Rapid release may propel gas cylinder if not properly secured.
- “low” concentration in tank may produce high concentration in air
- Some require gas cabinet, like fluorine or hydrogen fluoride, and some require special venting or installation, like hydrogen and ammonia.



32

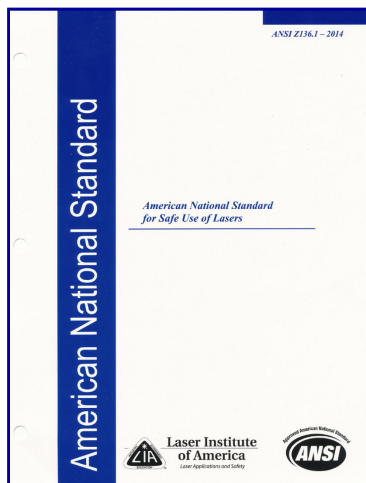
LASER SAFETY STANDARDS

Lasers may be classified and have requirements for safe use listed under:

- **The Federal Laser Product Performance Standard (FLPPS) manufacturers** of the Center for Devices and Radiological Health (CDRH), which is a division of the Food and Drug Administration (FDA) 21 CFR 1040.10 and 1040.11
- **The American National Standard for Safe Use of Lasers (ANSI Z136.1)**
This is a Standard that applies to the use of lasers, that is recognized by
 - The Occupational Safety and Health Administration (OSHA)
 - The Texas Department of State Health Services (TDSHS)
- TDSHS – authorizes UHCL Laser License and sets Laser Safety Requirements, mostly in 25 TAC 289.301
 - State regulations
- IEC 60825 International Standard - for companies with international operations

33

OVERVIEW OF ANSI Z136.1 Standard



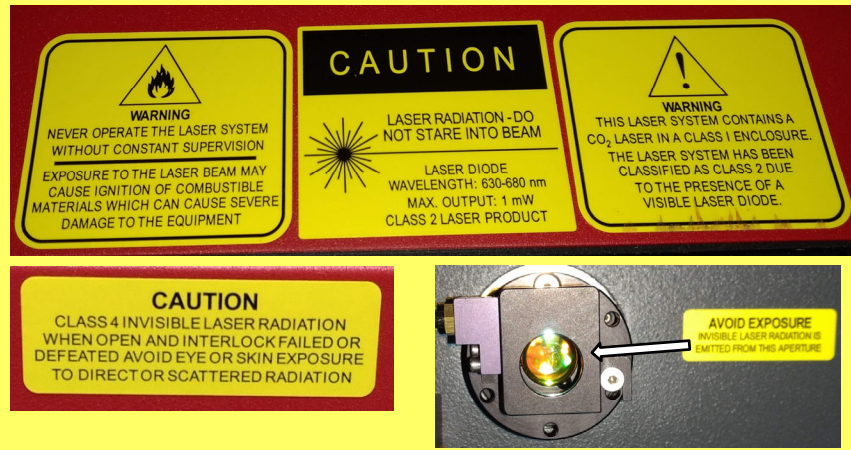
1. MANAGEMENT APPOINTS LASER SAFETY OFFICER
2. LSO VERIFIES LASER CLASSIFICATION
3. LSO EVALUATES HAZARDS BY DETERMINING
 - Maximum Permissible Exposure (MPE)
 - Optical Density (OD) Required on eyewear
 - Nominal Hazard Zone (NHZ) – laser enclosure
4. LSO SPECIFIES CONTROL MEASURES
 - ENGINEERING CONTROLS
 - Enclosures
 - Interlocks
 - Warning Systems
 - ADMINISTRATIVE AND PROCEDURAL CONTROLS
 - Authorized Personnel
 - SOP (Including Alignment)
 - Training
 - PERSONAL PROTECTIVE EQUIPMENT (PPE)
 - Eyewear
 - Barriers

34

WARNING LABELS

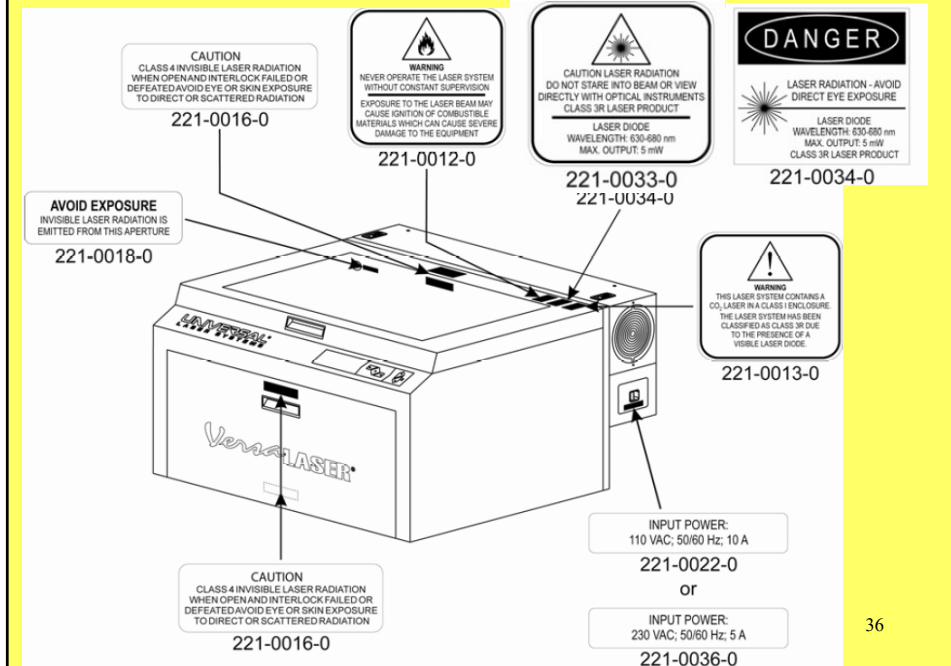
Do not remove or cover any of the warning labels. If any need replaced, contact the PI and/or manufacturer.

Mechanical Engineering Laser: ULS Support at 480-609-0297 or email support@ulsinc.com for free replacement.



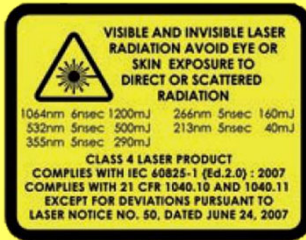
26

Mechanical Engineering Laser Cutter Warning Labels



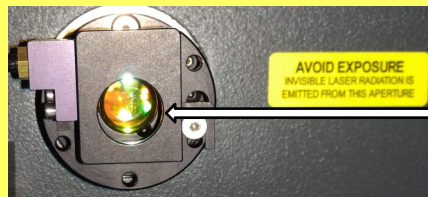
36

WARNING LABELS Physics Research



37 26

OTHER REQUIRED CDRH LABELS



Aperture label, where laser is emitted

This product complies with the provisions of 21 CFR 1040.10 & 1040.11 at date of manufacture

Certification Label on back of unit

Name of Manufacturer
 Address of Manufacturer
 Date of Manufacture

Manufacturer Identification Label on back of laser

38

LASER CONTROL MEASURES

(ANSI Section 4.1)

- Engineering
- Administrative (Procedural)
- Personal Protective Equipment (PPE)



The advertisement for KENTEK laser safety products is organized into four main sections, each with a color-coded header and representative images of the equipment:

- LASER EYEWEAR** (Purple header): Includes images of safety glasses, goggles, and a face shield. Subtext: "Glasses • Goggles • Face Shields".
- LASER BEAM EVALUATION** (Blue header): Includes images of various detectors and power meters. Subtext: "IR & UV Laser Detectors • Power Meters".
- LASER CONTAINMENT** (Green header): Includes images of barriers, curtains, window blocks, and window shades. Subtext: "Barriers • Curtains • Window Blocks • Window Shades".
- LASER CONTROL MEASURES** (Orange header): Includes images of area access control systems, signs, and beam dumps. Subtext: "Area Access Control Systems • Signs • Beam Dumps".

Below these sections, the text reads: "...and MORE! Your STORE for everything laser safety." At the bottom, the KENTEK logo is displayed with the tagline "Laser People Helping Laser People" and the website address kenteklaserstore.com.

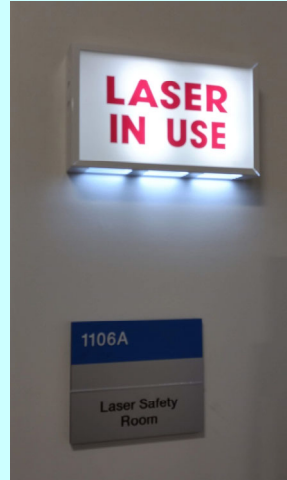
Should the Laser Cutter be modified, the LSO must designate: OPEN BEAM CONTROL MEASURES

ANSI Z136.1-2007 Section 4.3.1.1

Any time there is an exposed Class 3B or Class 4 beam:

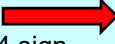
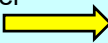
- ☀ Laser Controlled Area
- ☀ Laser Eye Protection
- ☀ Beam Control
- ☀ Administrative and Procedural Controls
- ☀ Education and Training

CLASS 4 LASER CONTROL AREA




41

CLASS 4 LASER CONTROL AREA

- Room Access, and Laser Operation by trained personnel only
- Post Danger sign in Open Beam Hazard Zones 
- Physics Research Class 4 sign
- Enclosed, protected Class 4 CO₂ Laser Cutter operates as a Class 1 low hazard System with reduced requirements.
- Laser cutter is Class 2 based on the alignment diode laser
- Key removed when not in operation, and stored away from the cutter.
- Caution sign posted in laser cutter room for Class 2 

 DANGER	
	<p>Class 4 Laser Controlled Area Avoid eye or skin exposure to direct or scattered radiation. Visible and Invisible Laser Radiation. Laser Protective Eyewear Required. Trained Personnel Only, Knock Before Entering. Diode Max 550mW, 400-1000nm</p>

 CAUTION	
	<p>Class 2 Laser Controlled Area Visible Red Diode Laser, wavelength: 650-680 nm, Max Output: 1 mW Enclosed Class 4 Laser Invisible CO₂ Laser, wavelength: 10,600 nm, Max Output: 50 W Avoid eye or skin exposure to direct or scattered radiation. Trained Personnel Only Do Not stare at material combustion light, or use collecting/magnifying optics. Serious eye and skin injury may result if safety interlocks or housing are removed.</p>

CLASS 4 LASER CONTROL AREA

- All requirements of Class 3B lasers plus additional **Laser Security, Inventory Control and Safety Requirements**
- Rapid egress at all times under emergency conditions
- Clearly marked “Emergency Stop” or other marked device
- Required Entryway Controls & Security
 - Doorway or barrier lock
 - Door kept shut and locked when not in use
 - Interlocks (on laser cutter)
 - Procedural
 - Training prior to entry and use
 - Laser Cutter top glass lid has a protective coating for its CO₂ laser in lieu of eyewear



43

Mechanical Engineering Enclosed Class 4

- The Laser Cutter contains a Class 4 50 watt CO₂ Laser in an enclosed system, which means it operates as Class 1 system, or Class 2 with the alignment diode laser.
- Doors magnetic interlocked to shut CO₂ laser off when opened.
- The top viewing glass has protective finish rated to Optical Density (OD) 5+ per manufacturer (though not labeled).
- As long as the interlocks are in place and the cutter only operates with doors shut, inside the equipment contains the laser and no safety eyewear is required.
- Do not operate if the viewing glass is damaged, if any of the safety interlocks are defeated, or with any doors open
- Should there be damage to the equipment, discontinue use and notify faculty for repair prior to operation resuming.
- There are no field serviceable parts. If service is needed, contact ULS Factory Support team.

44

SAFETY INTERLOCK STATUS For Mech Eng Laser Cutter

A Green LED indicates the machine power on.

A **Red LED** on the control panel **provides system interlock status.**

RED LED

Condition

- **On** The top lid of the laser system is closed. If a laser job is initiated in this state, the CO2 laser will operate.
- **Flashing** The top door to the laser system is open and the safety interlock system has disabled the CO2 laser. If a laser job is initiated in this state, the CO2 laser will not fire and the red diode alignment laser will be on instead.



45

LASER OPERATIONAL STATUS

Use of regulated lasers requires audible and/or visual warning when the laser is on, to alert others both outside and inside the entrance to a controlled room.

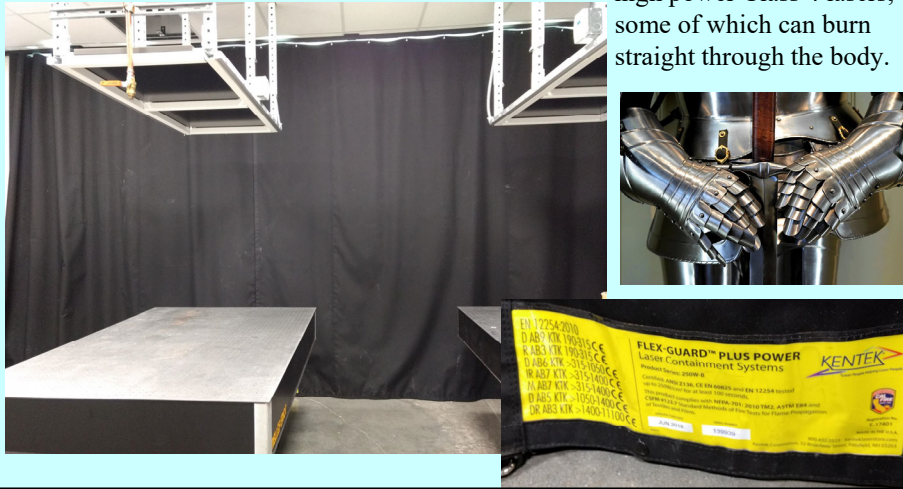


LET OTHERS KNOW
WHEN YOU

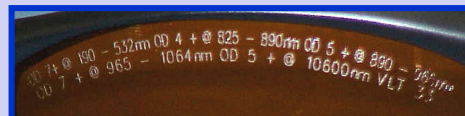


BEAM CONTROL

The Laser beam pathway should be known and controlled at all times, with the area uncluttered to prevent stray reflections, laser curtain blocking windows, and beam or laser table enclosed where possible. There is no skin protection available for the high power Class 4 lasers, some of which can burn straight through the body.



LASER SAFETY EYEWEAR



Special laser safety eyewear must be worn with open beams of class 3 and 4 lasers. All eyewear must be chosen to provide adequate protection for the wavelength and power used, and the eyewear must be labeled with Optical Density (OD) protection provided per wavelengths. Available for \$100-200+

LASER SAFETY EYEWEAR



190 – 532 nm http://www.ahix.com/ 190 – 449nm OD 5+ 450 – 532 nm OD 6+	Orange Lens Model A-NS32-ARG
625 – 850 nm 190 – 400 nm OD 5+ 625 – 850 nm OD 4+ 622 – 825 nm OD 5+	Navy Lens Model A-N635/808-014
840 – 1070 nm 190 – 400 nm OD 5+ 840 – 950 nm OD 5+ 950 – 1070 nm OD 7+	Yellow-Green Lens Model A-N980-VG3
650 nm, 80 mW - Alignment www.lentelaserstore.com 650 – <655 nm OD 2+ 655 – 685 nm OD 3+ >685 – 690 nm OD 2+ 770 – <785 nm OD 2+ 785 – 830 nm OD 3+ >830 – 845 nm OD 2+	Aqua Lens Model KRA-5814
StellarNet Spectrometer: www.noirlaser.com 190 – 420 nm... OD 5+ 765 – 1100 nm OD 5+ 775 – 1085 nm OD 6+ 790 – 1080 nm OD 7+	Green Lens Model ML1#36
Quantel Q-Smart www.lentelaserstore.com 532 nm OD 7+ 1064 nm OD 7+ 755-810 nm OD 5+ 810-840 nm OD 4+ 950-1700 nm OD 5+ 2100-3200 nm OD 5+ 2900-3200 nm OD 5+ 10600 nm OD 5+	Clear Green/Pink Lens Model KBS-C505C

49

WORKING SAFELY WITH LASERS

Who has Primary Responsibility for laser safety any time a Class 3b or Class 4 laser is operated?

The person(s) Operating the laser always have primary responsibility for all hazards associated with laser use.

REQUIRED SAFE WORK PRACTICES

- Never intentionally look directly into a laser. Do not stare at the light from any laser beam or light generated during the cutting process, which is the product of material combustion or vaporization. Blink and move your eyes away.
- Do not view a Class 3R (or any higher power) laser with optical instruments such as binoculars or microscopes, or redirect with a reflective surface.
- Never direct the beam toward other people.
- Operate lasers only in the area designed for their use and be certain that the beam is terminated at the end of its use path. Never allow a laser beam to escape its designated area of use.
- Never use a laser in a manner other than its intended and applied for use

51

REQUIRED SAFE WORK PRACTICES

- Position the laser so that it is well above or below eye level, both when standing and sitting.
- Remove all unnecessary objects from the area near the beam's path, especially reflective items.
- Check for stray reflective beams.
- **DO NOT OPERATE THE LASER SYSTEM IF ANY SAFETY FEATURES HAVE BEEN MODIFIED, DISABLED, OR REMOVED.** This may lead to severe eye damage and/or burns to the skin.
- Laser safety eyewear and other controls are required (for the Mechanical Engineering Laser Cutter) if a class 3B or 4 laser beam is not contained, which may be invisible to the human eye. Contact the Laser Safety Officer for this setup if a modification to an enclosed system is needed

52

SAFE BEAM ALIGNMENT

- ANSI REQUIRES approved, written alignment procedures for ALL class 4 laser alignment activities and recommends them for class 3B.
- Exclude unnecessary personnel from the laser area during alignment.
- Where possible, use low-power visible lasers for path simulation of high power lasers, or use high-power lasers at the lowest possible power level.
- Block high-power beams at their source except when actually needed during alignment.
- Alignments should be done only by those who have received laser safety training, are thoroughly familiar with the equipment, and approved by the PI and Laser Safety Officer for alignment.
- The laser cutter uses a class 2 laser for alignment purposes.
- Use the alignment procedures provided by the manufacturer or utilize templates that incorporate all aspects mentioned for alignment in the ANSI standard. Alignment procedures are reviewed and approved by the PI and LSO.

53

SAFE BEAM ALIGNMENT

Laser Cutter Instructions for Alignment (by manufacturer):

(done only by those approved, with laser safety training)

1. Open the top door / glass lid.
2. Place a small piece of masking tape across the 3/4" (19 mm) hole in the focus carriage. Gently rub the tape around the edge of the hole so that you can see the outline of the hole through the tape.
3. Power on your computer and verify that the Universal Control Panel (UCP) icon is present in the taskbar. If not, activate it by selecting the "Universal Control Panel" icon on your desktop.
4. Power on the laser system by pressing the Power switch on the side of the laser system.
5. With the top door open, a red dot will appear on the masking tape from the low power red diode laser for aligning. The red dot should appear centered, within 1/8 inch (3 mm). If not, turn off the laser system, remove and re-install the laser cartridge (per instructions pp.16-18) and try again. If the red dot still does not appear centered, please contact our Customer Service Team at 480-609-0297 or e-mail us at support@ulsinc.com.
6. Once you have verified laser beam alignment, remove the masking tape.

54

Laser Cutter Manufacturer Information

- Cutting and engraving depth are controlled by specifying the speed of processing, the laser power level, and number of pulses per inch (PPI). See the Printer Driver Interface info.
- Work Area Maximum Size is **32 x 18 in.**
- Never operate the laser system without constant supervision of the cutting and engraving process. Exposure to the laser beam may cause ignition of combustible materials which can lead to a fire. A properly maintained fire extinguisher should be kept on hand at all times.
- Allow material to cool, and remove all from machine after use, including scraps.
- It is important to keep the laser system as clean as possible to ensure trouble free operation and best results. Accumulation of dirt and debris on the motion system components will cause uneven or rough engraving, loss of engraving position and premature failure. Accumulation of smoke or dirt on optics can result in loss of laser power and premature failure.
- Always turn the laser engraving system OFF and unplug it before performing any cleaning procedures. Remove loose dirt and debris from inside the laser system with a vacuum cleaner. Clean the processing table surface with either a soap solution, or alcohol, and a cloth or paper towels (acetone can be used in extreme cases to remove gummy deposits, but should be handled carefully as it will melt plastic components of the laser system). Always dampen your paper towel or cloth, never pour or spray any solution directly into the laser system.

55

CAUSES AND FACTORS OF LASER ACCIDENTS

- Inadequate training of laser personnel
- Operators unfamiliar with laser equipment
- Defeating safety interlocks
- Improper restoration of equipment following service
- Misaligned optics and upwardly directed beam
- Placing unprotected eye at level of laser beam
- Viewing of laser generated plasmas
- Eye or skin injury of photochemical, beam molecular destruction
- Lack of protection from non-beam hazards
- Inhalation of laser generated air contaminants (LGAC's)
- Fires resulting from ignition of materials
- Failure to follow SOP or safe work practices

56

Incident Reporting

- Obtain immediate medical attention upon injury to the eye(s) or skin. Police at x.2222 can route medical personnel to room location.
- Contact the Laser Safety Officer (LSO) Lisa Coen at x.2107, after hours 832-260-6975 or ask Police at x.2222 to contact LSO.
- Incident Reports must be submitted within 24 hours to EHS@uhcl.edu. There are separate reports for students and employees, as well as witness form.
- Partial or total loss of sight in either eye, or 2nd or 3rd degree skin burns **must be reported to the state within 24 hrs.**
- **Incident Report forms are located at:** <https://www.uhcl.edu/about/administrative-offices/environmental-health-safety/forms>
- Ensure the laser is turned off, and do not alter the area or use the laser until after an accident investigation is complete and the laser is cleared for use by the LSO.

57

Required Laser Area Postings



Texas Department of State Health Services

CERTIFICATE OF REGISTRATION FOR LASERS

Pursuant to the Texas Radiation Control Act, Title 25 Texas Administrative Code (TAC) §289 (as amended), and in reliance on statements and representations made by the registrant, this Certificate of Registration is issued authorizing the registrant to receive, possess, transfer or acquire radiation machines and to use such machines for the purpose(s) and at the place(s) designated below. This registration is subject to the Texas Radiation Control Act, all applicable rules, regulations, and orders of the Texas Department of State Health Services in effect and to the conditions in this certificate.

Name and Mailing Address of Registrant:

UNIVERSITY OF HOUSTON - CLEAR LAKE
ATTN MELISSA (LISA) JOY COEN LSO
2700 BAY AREA BLVD
HOUSTON TX 77058

703310
Registration Number
31 MARCH 2022
Expiration Date

CONDITIONS

1. The authorized use location(s) is:

Site:	Location
000	2700 Bay Area Boulevard, Houston, 77058
2. The individual designated to perform the functions of laser safety officer for this registration is **Melissa (Lisa) Joy Coen**.
3. The registrant **shall notify** the Agency, in writing, of any changes in the information shown on the application for registration or this Certificate of Registration in accordance with 25 TAC §289.301.
4. The registrant shall comply with the provisions of 25 TAC §289.203, §289.204, §289.205, §289.231, and §289.301.
5. Deliberate laser radiation exposure of humans is prohibited. Lasers authorized for academic, educational and research are for use with phantoms only.
6. This certificate will remain in effect until the expiration date, a written request for termination is submitted by the registrant, or restrictive action is taken by the Agency. This does not alleviate the registrant's responsibility to comply with 25 TAC §289.301. If the registrant files a renewal application prior to the expiration date, the Certificate of Registration will not expire until the application status has been finally determined by the Agency.

Issuance of this Certificate of Laser Registration does not alleviate you from compliance with any outstanding notices of violation or payment of any fees due.

02 MAY 2022
Date Issued

Mulan Jin
Registration Officer
Mulan Jin

Required Laser Area Postings

RC FORM 203-1
(February 2010)

Department of State Health Services
1100 West 49th Street
P.O. Box 149347
Austin, Texas 78714-9347

NOTICE TO EMPLOYEES

TEXAS REGULATIONS FOR CONTROL OF RADIATION

The Department of State Health Services has established standards for your protection against radiation hazards, in accordance with the Texas Radiation Control Act, Health and Safety Code, Chapter 401.

YOUR EMPLOYER'S RESPONSIBILITY

Your employer is required to:

1. Apply these rules to work involving sources of radiation.
2. Post or otherwise make available to you a copy of the Department of State Health Services rules, licenses, certificates of registration, notices of violations, and operating procedures that apply to your work, and explain their provisions to you.

YOUR RESPONSIBILITY AS A WORKER

You should familiarize yourself with those provisions of the rules and the operating procedures that apply to your work. You should observe the rules for your own protection and protection of your co-workers.

WHAT IS COVERED BY THESE RULES

1. Limits on exposure to sources of radiation in restricted and unrestricted areas;
2. Measures to be taken after accidental exposure;
3. Individual monitoring devices, surveys and equipment;
4. Caution signs, labels, and safety interlock equipment;
5. Exposure records and reports;
6. Options for workers regarding agency inspections; and
7. Related matters.

REPORTS ON YOUR RADIATION EXPOSURE HISTORY

1. The rules require that your employer give you a written report if you receive an exposure in excess of any applicable limit as stated in the rules, license, or certificate of registration. The basic limits for exposure to employees are stated in 25 Texas Administrative Code (TAC) [289.202(f), (g)].

- (i), and (m) (relating to Standards for Protection Against Radiation from Radioactive Materials) and 25 TAC [289.211(m)] (relating to General Provisions and Standards for Protection Against Machine-Produced Radiation). These subsections specify limits on exposure to radiation and exposure to concentrations of radioactive material in air and water.
2. If you work where individual monitoring devices are provided in accordance with 25 TAC [289.202 or 289.231]:

- (a) your employer must furnish to you, upon your written request, an annual written report of your exposure to radiation; and
- (b) your employer must give you a written report, upon termination of your employment, of your radiation exposures if you request the information on your radiation exposure in writing.

INSPECTIONS

All licensed or registered activities are subject to inspection by representatives of the Department of State Health Services. In addition, any worker or representative of the workers who believes that there is a violation of the Texas Radiation Control Act, the rules issued thereunder, or the terms of the employer's license or registration with regard to radiological working conditions in which the worker is engaged, may request an inspection by sending a notice of the alleged violation to the Department of State Health Services. The request must state the specific grounds for the notice, and must be signed by the worker or the representative of the workers. During inspections, agency inspectors may confer privately with workers, and any worker may bring to the attention of the inspectors any past or present condition that the individual believes contributed to or caused any violation as described above.

POSTING REQUIREMENT

Copies of this notice shall be posted in a sufficient number of places in every establishment where employees are employed in activities licensed or registered, in accordance with 25 TAC [289.213] (relating to Licensing of Radioactive Material) and 25 TAC [289.216] (relating to Registration of Radiation Machine Use and Services), to permit employees to observe a copy on the way to or from their place of employment. Applicable sections of 25 TAC Chapter 289 may be reviewed online, at www.dshs.state.tx.us/radiation/rules.shtml

NOTICE OF DOCUMENTS LOCATION

AS REQUIRED BY THE TEXAS REGULATIONS FOR THE CONTROL OF RADIATION TITLE 25 TAC CHAPTER 289, THE DOCUMENTS BELOW MAY BE EXAMINED AT THE:

Environmental Health & Safety Department
North Office Annex, Room 104
2700 Bay Area Blvd., Box 362
Houston, Texas 77058

MONDAY THROUGH THURSDAY, FROM 8:00 AM TO 5:00 PM

TEXAS REGULATIONS FOR THE CONTROL OF RADIATION
OPERATING AND SAFETY PROCEDURES

LASER REGISTRATION,
CONDITIONS AND AMENDMENTS
STATE INSPECTIONS
AND

CORRESPONDENCE WITH THE TEXAS DEPARTMENT OF STATE HEALTH SERVICES