Fermilab-specific content to supplement DOE's laser safety training course

Differences from DOE laser training

a.k.a., we do things a little differently here at Fermilab

DOE training says…	**Fermilab actually does…**	**Discussion**
Laser safety training must be repeated every 36 months.	Fermilab does not require repetition of laser safety training.	The DOE referenced standard (ANSI Z136.1-2000) does not require repetition of laser safety training.
Post-2007 laser hazard classifications include 1M, 2M, and 3R.	Fermilab does not use post-2007 laser hazard classifications.	The DOE referenced standard (ANSI Z136.1-2000) does not use post-2007 laser hazard classifications.
Call “911” in any emergency.	On the Fermilab site, call “3131” in any emergency.	
Contact “hazards control organization” for additional help.	Contact “division/section ES&H organization” for additional help.	
In a “laser controlled area” (LCA) activities are controlled to protect people against laser radiation. In a “nominal hazard zone” (NHZ) the MPE is exceeded.	Fermilab treats LCA and NHZ the same and refers only to the NHZ.	LCA and NHZ were combined at Fermilab for the sake of simplicity.
Use NOTICE signs for temporary laser set ups.	Fermilab uses DANGER and CAUTION signs for temporary set ups, as well as long-term set ups.	One posting system is used at Fermilab for the sake of simplicity. Strictly speaking, NOTICE signs are to provide instructions, while CAUTION/DANGER signs are to warn of hazards.

Laser safety roles worth knowing

- ***Laser system manager*** – Person responsible for managing a laser system that emits harmful levels of laser radiation.
- ***Laser operator*** – Person who operates a laser system that emits harmful levels of laser radiation
  - ***Qualified laser operator*** – A laser operator who has met requirements for safety training, eye exam, and management authorization

Basic laser beam safety

It’s all about the risk of inadvertent beam injury

Low - class 1, 2 & 3a

- Must engage in overtly risky behavior to get injured
- This includes things like staring into the beam and disassembling laser devices
- Few controls

High - class 3b & 4

- Need to know what you’re doing to avoid injury
- Eye injury can occur within 0.25 second
- Many controls

More about 3b/4 beam hazards

Class 3b

- 0.25 second eye hazard for direct or specularly-reflected beam
- Injury requires a “direct hit” on eye

Class 4

- 0.25 second eye hazard for diffusely-scattered beam
- Unenclosed beam always an eye hazard
- Skin, fire, and thermal decomposition hazards must be considered

Controls for unenclosed 3b/4

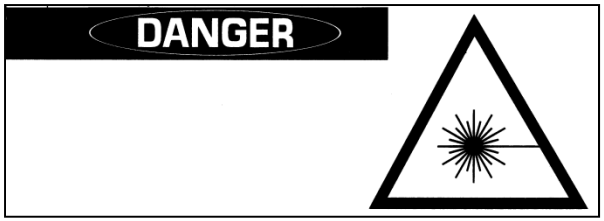
- Qualify operators
  - General laser safety training (this course)
  - Laser eye exam (offsite / contact Medical X3232)
  - Process-specific training from system manager
  - System manager authorization
- Use signs and labels
- Wear laser eyewear (optional for 3b)
- Escort the unqualified(optional for 3b)

Signs and labels

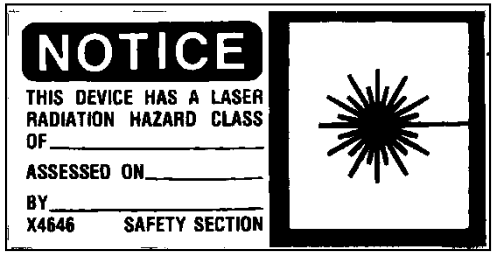
- Post areas with signs
  - Post where they best warn potentially-exposed people (e.g., doors)
  - Avoid long-term posting of signs
    - People learn to ignore warning
    - Use magnets, velcro, illumination
- Label equipment & devices
  - Provides cautionary information
  - Provides a means for inventory
- Suggested layouts in ES&H Manual 5062.1.

Examples

Area sign



Inventory/Classification label



Escorted access

- Unqualified personnel may participate in unenclosed hazard class 4 operations if escorted by a qualified laser operator
- The qualified laser operator must…
  - Assume responsibility for safety of participants
  - Provide a briefing about hazards and precautions
  - Provide appropriate protective equipment
  - Be present at all times that participants are present

Isolation – a basic control

Goal: Keep people away from harmful levels of laser radiation

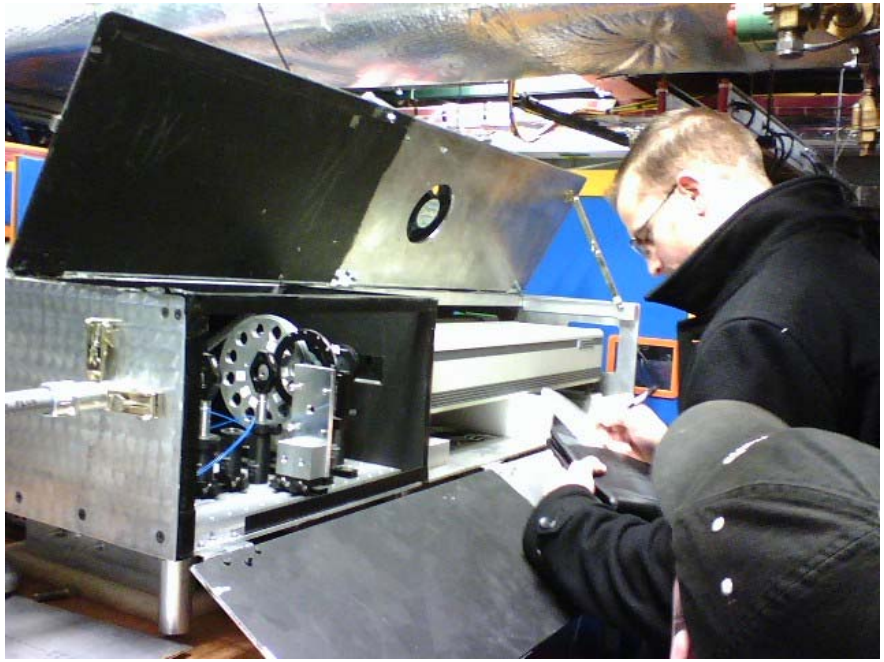
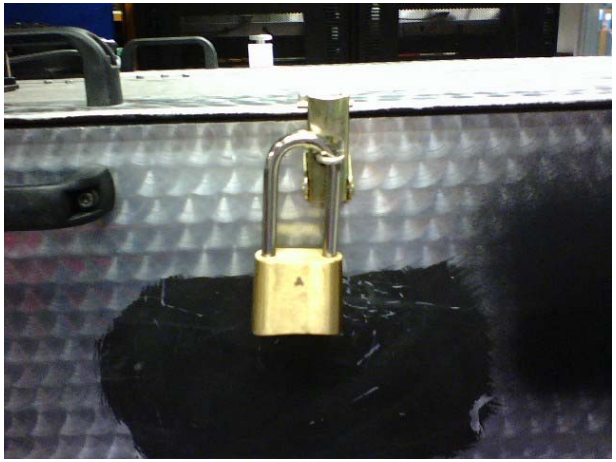
- Good – Unqualified people kept away from open laser beam(s) in a way that relies on common sense and trust (e.g., safety tape)
- Better – Open laser beam(s) in a light-tight room with only qualified allowed inside
- Best – An enclosed light-tight laser system "box" that qualifies for Class 1 status

Isolation - box or room approach

Goal: Reduce hazard class

- Usually aim to drop Class 3b/4 to Class 1
- Enclose as much of beam path as possible
- Fiber optics can be part of enclosure
- “Good enough” radiation tightness - OK
- Enclosure must be locked or interlocked
- Added benefit: protects your laser set-up

To lock or interlock?

- Locked enclosure (typical for box)
  - “Tool” required to open enclosure (can be a key)
  - Warning message also required
    - Label(s) on box
    - Sign(s) on room door(s)
  - *Objective:* opening enclosure must be deliberate act
- Interlocked enclosure (typical for room)
  - Opening enclosure turns off beam

Example - CDF laser box