

# Safety in the Laboratory

- House keeping
- Mechanical hazards
- Laser hazards
- Electrical hazards

# Cluttered workplace is unsafe. Clean up your workplace for a **safe and efficient** work environment



# Do not store large quantity of solvents in the lab and no solvent bottles on the floor





# No food or drinks in the laboratory



- Eating and drinking in the lab is **poisoning hazard**
- You also invite **rats** and **cockroach** into your laboratory

# Do not block open fire doors and laboratory doors



# Always secure your gas cylinders – one chain for one cylinder

Tie at  $\frac{2}{3}$  of  
the height of  
the cylinder





# Don'ts



- Too many cylinders on one chain
- Two cylinders – one chain
- Tie at the neck of cylinder
- Chain too low
- Loose chain
- Free standing cylinders

# Transport of gas cylinders and liquid nitrogen in passenger lifts : LG2 – G/F

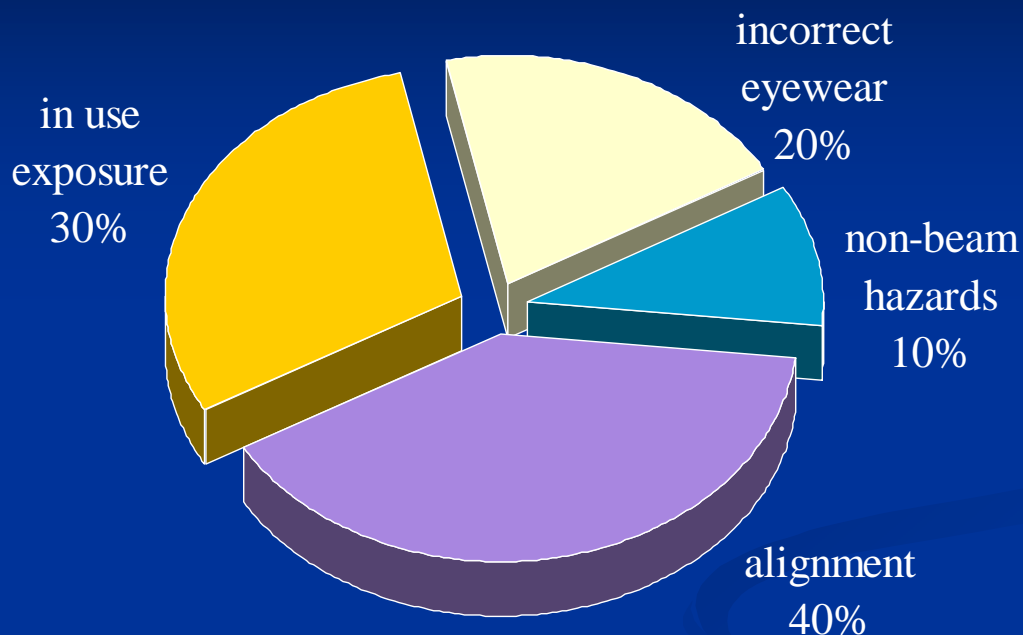
- Updated procedures – Safety Handbook p.21
- block off the lift – no passenger
- 2 persons – one to move the cylinder into the empty lift, the other one to pick up the cylinder on the receiving floor



# Laser Hazards

- Serious burns to the skin and outer layers of the eyes (cornea)
- Serious damage to interior tissues of the eyes (especially the retinal layer) even at exposure levels harmless to skin and the front of the eyes
- Other hazards: electric shock, fire, ionizing radiation

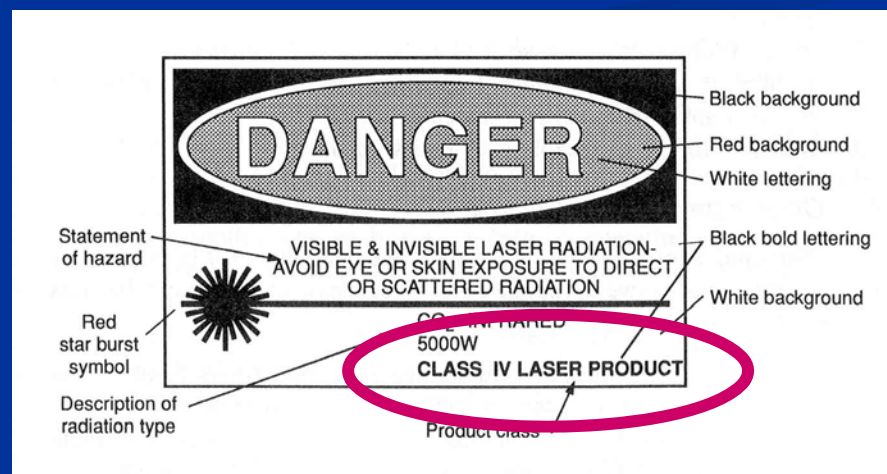
# Major Causes of Laser Accidents



- You must have proper **training** by your supervisor before operating a laser
- Never walk into a laser laboratory without **proper eye protection**

# Know your laser hazard before entering a laser laboratory

- Class of the laser
- Wavelength of the laser
- Pulse energy and duration of the laser
- Warning light outside of the laboratory



U.S. Department of Labor, Occupational Safety & Health Administration, OSHA Technical Manual, Chapter 6: Laser Hazards  
[http://www.osha.gov/dts/osta/otm/otm\\_iii/otm\\_iii\\_6.html](http://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html)



# Beware of Class 3B and 4 lasers

**Table 1.5** Principal laser radiation hazards according to the laser class

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Class 1	Safe, due to very low radiant emission
Class 2	(Covers visible emission only) Possible eye hazard other than for accidental momentary viewing
Class 3A	Eye hazard if magnifying viewing instruments are used to view or intercept the beam
Class 3B	Hazard to the unaided eye. The viewing of diffuse reflections is normally safe. Can also exceed the skin safety threshold, but would not be expected to cause serious harm to the skin
Class 4	Eye and skin hazard. Diffuse reflections may also be hazardous. Possible fire and fume hazard by interaction with target material

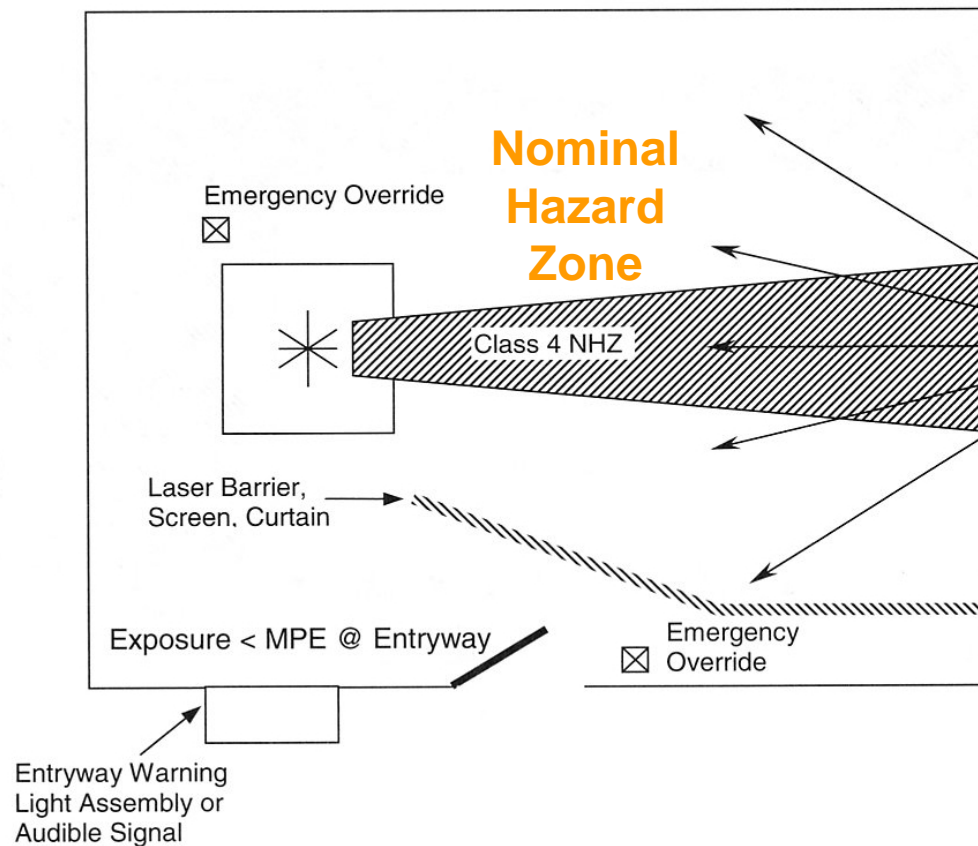
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## References:

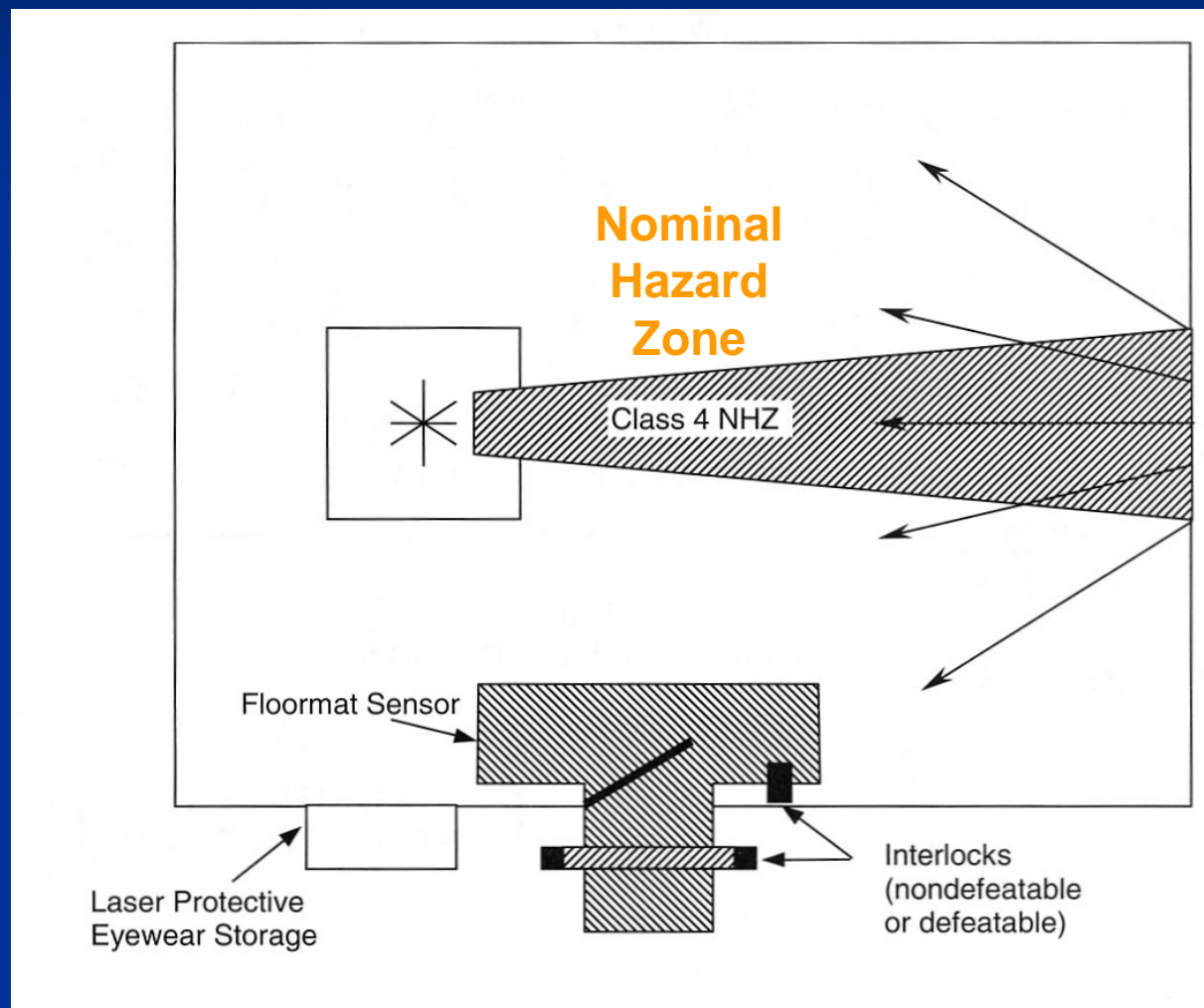
1. **ANSI Z136.1 (2000) Standard "Safe Use of Lasers"**, American National Standards Institute, Inc.
2. **OSHA Technical Manual, SECTION III: CHAPTER 6 LASER HAZARDS**  
[http://www.osha.gov/dts/osta/otm/otm\\_iii/otm\\_iii\\_6.html](http://www.osha.gov/dts/osta/otm/otm_iii/otm_iii_6.html)

# Entryway Safety Controls for Class 4 Lasers without Entryway Interlocks

**MPE –  
maximum  
permissible  
exposure**



# Area/Entryway Safety Controls for Class 4 Lasers Utilizing Entryway Interlocks





# General Rules of Laser Safety

- Turn the laser on only when required
- Always be aware where the beam is shining
- Never allow the laser beam to fall on the naked eye
- Never allow the beam to scatter off reflecting objects, *e.g.*, glass face of a watch, rings, metal stands
- Wear suitable protective goggles or glasses - make sure everybody in the laboratory does the same
- Use the correct laser goggles - each laser type will require different goggles
- Know the NOHD (nominal ocular hazard distance – the distance you can work without wearing goggles) of your laser

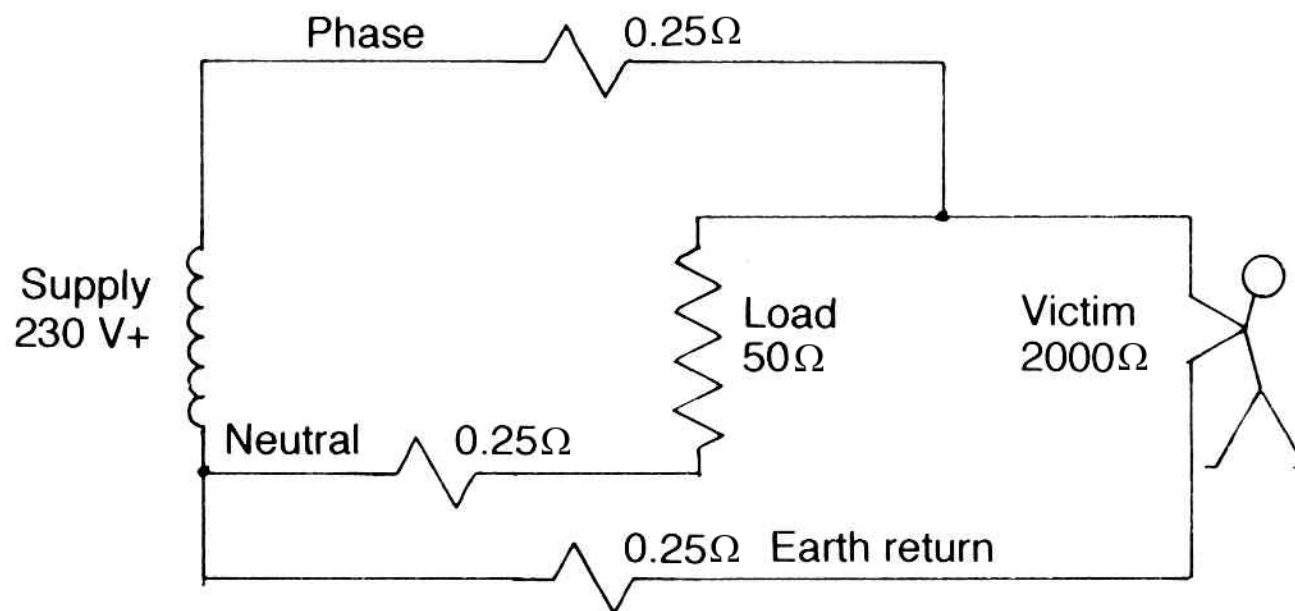
# Electrical Hazard:

## It is the **current** that **kills**

**Table 7.1** The effect of passing a shock current through the body from hand-held electrodes.

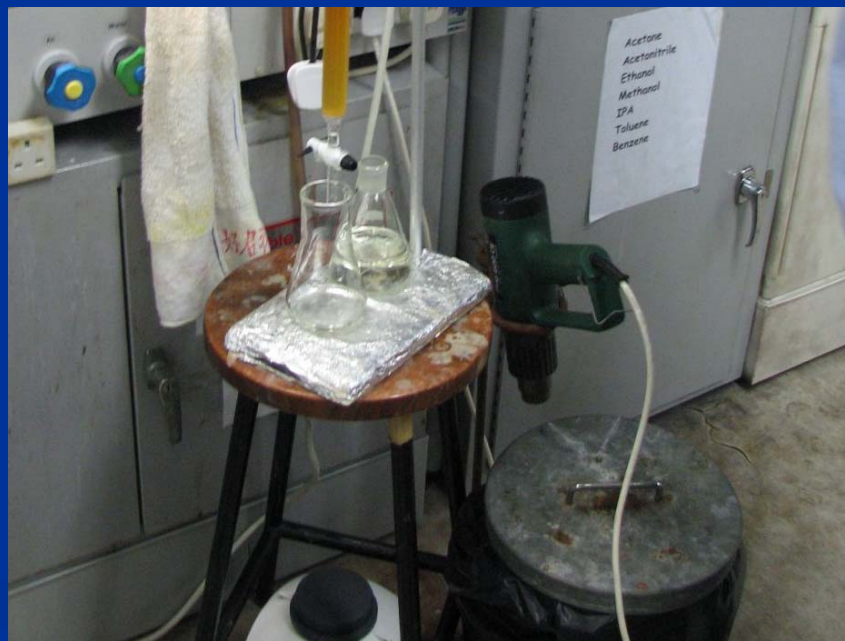
Current in mA	Effect
0.5–2	Threshold of perception.
2–10	Painful sensation, increasing with current.
10–25	Cramp and inability to 'let go'. Increase in blood pressure. Dangers of asphyxiation from respiratory muscular contraction.
25–80	Severe muscular contraction, sometimes involving bone fractures. Increased blood pressure. Loss of consciousness from heart and/or respiratory failure.
Over 80	Burns at points of contact. Death from ventricular fibrillation (uncoordinated contractions of the heart muscles so that it ceases to pump).

# Electrical Safety



$$i = \frac{V}{R} = \frac{230}{2000} = 0.115 \text{ A} = 115 \text{ mA}$$





# General Rules of Electrical Safety

- Be alert: check and remove exposed contacts, damaged wire, *etc.*
- Be tidy: label wires and plugs
- Keep your hands dry and keep water away from equipment.
- Observe the **one hand rule**
- No power cable on the floor
- Be careful of capacitors – they may remain charged long after disconnected from power supply
- Current trips and fuses for all equipment
- Good grounding for all instrument

# Web resources

<http://chem.hku.hk/~chemhome/download/safety2010>