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LASERS

Laser

Light Amplification by Stimulated Emission of Radiation

The wavelength of lasers : IR, visible and UV spectra

IR lasers: neodymium:yttrium, aluminum garnet and carbon dioxide lasers

Visible light lasers: dye, helium–neon, and krypton lasers

UV lasers: excimer lasers (argon–fluoride or xenon–chloride). These are used for tissue excision purposes

ANSI (American National Standards Institute) laser classification

Class of laser Potential danger

I ..... Essentially harmless

II ..... Essentially harmless (do not stare at the laser)

IIIa and IIIb .....Hazardous

Direct viewing is very dangerous

Specular reflections are also dangerous

Skin exposure is harmful

IV ..... Extremely hazardous

Direct viewing must not occur

Specular reflections extremely dangerous

Diffuse reflections extremely dangerous

Skin exposure extremely hazardous

Fire hazard

A great deal of concern has arisen recently over the increasingly widespread use of laser pointers

Although permanent retinal damage has rarely been reported from laser pointers (most of which are class II or IIIa), this requires uninterrupted eye contact in excess of 10 seconds, making inadvertent injuries unlikely

Laser surgery or any other tissue use of class IV lasers will inevitably generate smoke

this plume contains viable infectious agents (both viruses and bacteria), toxic gases (benzene, hydrogen cyanide, and formaldehide)

Medical Use of UV lasers: Equivalent of 1 day sunbathing

Laser Protection

- Ideally, lasers should be enclosed during use
- Laser-using facilities must also be carefully designed to prevent reflections
- They should be well lit so that the pupils are not dilated

The eyes and skin are best kept out of the beam by interlock devices, which turn off the laser electronically or provide physical barriers between the operators or bystanders and the beam during operations

Not all research or medical laser activities are amenable to interlock protection

Laser surgery is a prime example

In such circumstances, personal protective devices are then used

Eye shielding must be selected in accordance with the wavelength of the laser used and should include side shielding

Absorptive filters are generally preferred over reflective types because absorptive filters are reliable regardless of the incident angle of the beam

A problem with optical density markings on laser-protective eye wear has been uncertainty with the reliability of the manufacturers' markings concerning transmittance

Independent checks are not truly achievable with available equipment

so it is important to identify reliable suppliers

Another problem with eye protection is that complete protection from visible beams blinds the user, interfering with safety and efforts at beam alignment

This tempts scientists to remove their eye protection to align the beam

Eye shields that are largely, but not absolutely, protective for open visible beam alignment operations

Laser retinal injuries continue to occur, despite the well-known safety precautions

Skin Protection

American Medical Association Council on Scientific Affairs:

specific recommendations for skin protection against carbon dioxide laser burns in surgical fields

Carbon dioxide–nitrogen lasers emit invisible UV energy, so burns may potentially be severe before the hazard is appreciated

Medical Surveillance

preplacement evaluations,

evaluations at the time of suspected laser incidents,

termination evaluations

- ocular history
- visual acuity
- macular function (Amsler grid or similar pattern)
- contrast sensitivity (Arden sine wave or similar pattern)
- fundoscopic evaluation with careful documentation of abnormalities

The End