

ERGONOMIC and SAFETY ISSUES

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Introduction

- General Laser Safety
- Laser Classes
- Laser Hazards
- Safety Guidelines
- Training
- Ergonomics
- Summary

General Laser Safety

- Lasers can pose more of a hazard than ordinary light because they can focus a lot of energy onto a small area
- These laser safety precautions must be understood by all personnel and must be used during all phases of operation and maintenance
- American National Standard Institute for Safe Use of Lasers, ANSI Z136.1 - minimum standard for laser safety

Laser Classes

- Classification- basis for safety requirements
 - Biological Damage
 - Accessible Emission Limit (AEL)
- Parameters for classification
 - Laser Output
 - Radiation wavelength
 - Exposure Duration
 - Cross sectional area of laser beam

Laser Classes – cont.

➤ Class 1

- No damaging radiation levels
- Low risk of injury
- Laser printers

➤ Class 2

- Low power lasers (400-700 nm)
- Do not normally present a hazard
- Laser pointers

➤ Class 2a

- Special category – normally not hazardous and can be viewed directly up to 1000 seconds
- Supermarket barcode scanners

Laser Classes – cont.

- Class 3a
 - Medium power lasers
 - Present hazards if viewed using collected optics
 - Helium-Neon lasers
- Class 3b
 - Hazardous if viewed directly
 - Can produce hazardous diffuse reflection
 - Visible Helium-Neon lasers

Laser Classes – cont.

- Class 4
 - High power lasers
 - Produces hazards from direct, specular, or diffuse reflections
 - Pose eye, skin, and fire hazards

Laser Hazards

➤ Eyes

- Thermal Burn
- Acoustic Damage
- Photochemical Damage

➤ Skin

- Burns from acute exposure to high levels of radiation
- Carcinogenesis of the skin

➤ Chemical Hazards

- Organic Dyes are a major source of chemical hazards
- Gases from lasers or interaction of laser with target

Laser Hazards – cont.

➤ Electrical Hazards

- Most common non-beam hazard
- High voltage from power supplies and capacitor banks

➤ Secondary Hazards

- Vaporized Target Material
- Laser Gases
- Cryogenic Coolants
- Pump Lamps
- Ionizing Radiation
- Fire Hazards

Safety Guidelines

- Personal Protective Equipment (PPE)
- No rings, watches, or metallic apparel
- Do not handle electrical equipment if hands or feet are wet
- For high voltage, regard floors as conductive and grounded
- Emergency procedures
- Make sure power is disconnected before any maintenance is made to equipment

Safety Guidelines – cont.

- Engineering Control Measures
 - Protective Housing
 - Shutters
 - Safety Interlocks
 - Master Key Switch
 - Nominal Hazard Zone (NHZ) established
 - Beam Stop or Attenuator
 - Activation Warning Signal
 - Laser Control Area

Safety Guidelines – cont.

- Administrative Control Measures
 - Warning signs and labels
 - Standard Operating Procedures (SOPs)
 - Training
- PPE Control Measure
 - Protective Eyewear
 - Gloves
 - Special Clothing

Training and Qualification

- All users must complete a laser safety course
- Retraining is required at least once every three years
- Laser safety courses are offered regularly and are customized to meet requirements
- The Laser Safety Officer (LSO) is responsible for adequate training programs
- Training records must be maintained and kept up-to-date

Training and Qualification – cont

- Before operating the laser, the user must
 - Review the Laser Safety Manual
 - Receive from the LSO or lab supervisor a thorough review of the laser equipment, administrative requirements, alignment procedures, and applicable SOPs
 - Review operating and safety instructions furnished by manufacturer

Ergonomics

- Greek term – ergon (work) and nomics (rules or law) - defined as the “law of works”
- OSHA defines ergonomics as the science of “designing the job to fit the worker, instead of forcing the worker to fit the job”
- Cumulative Trauma Disorders (CTD’s)
 - Physical stressors that place pressure on parts of the body
 - Occurs gradually over weeks, months, years
 - Examples: carpal tunnel syndrome, epicondylitis, tenosynovitis, and bursitis

Ergonomics - cont

- Repetitive Strain Injuries (RSIs)
- Risk Factors
 - Repetition
 - Awkward position or posture
 - Excessive pressure or force
- Areas that will be addressed
 - Recognition
 - Prevention/Control
 - Solutions

Ergonomics - cont

➤ Recognition

- Observe the operation
- Analyze similar work related injuries
- Comment or Suggestions from workers

➤ Prevention/Control

- Determination of potential injuries
- Control of risk factors
- Overseeing of engineering controls
- Administrative control is necessary

Ergonomics - cont

- Solutions
 - Simple
 - Look to other sources for solutions
 - Provide a framework where everyone works together
 - Ongoing evaluations
 - Proper Training

Summary

- HQ AFMC/LGP-EV is tasked to write technical documents to include safe handling and operating of laser equipment
 - HQ AFMC/SG will be coordinating on safety and health documents
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