Rockwell Laser Industries

Advanced LSO - Calculations Workshop w/ Outdoor Use of Lasers 3-day (L-330)

Day One:

Introduction and Laser Safety Basics
Skin & Eye Biological Effects
- Mechanisms of interaction
- Effects on the skin and eye
- Comparison of injury data to MPE

MPE Calculations
- Dual limits for UV hazards
- Limiting apertures
- Correction factors
- Computations of MPEs
- Multiple wavelength analysis

Calculation Session 1 –Correction Factors and Multiple Wavelengths

Hazard Analysis of Gaussian Beams
- Irradiance and radiant exposure
- Conversion between 1/e and $1/e^2$ values
- Expressing MPE as power or energy
- Optical density calculations

Calculation Session 2 –OD and Conversions

Dual Limits and Multiple Pulses
- Dual limits in 1200 nm to 1400 nm band
- Three rules for multiple pulses
- Crossover frequency
- Pulse groups

Calculation Session 3 –MPE for Multiple Pulses and Pulse Groups

Day Two:

Extended Source Exposure
- Comparison of injury data to MPE for extended sources
- Criteria for extended sources
- Diffuse reflections
- Radiance and thermal MPEs

Calculation Session 4 –Extended Source Exposure

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MPEs Based on Both Thermal and Photochemical Effects
- Longer exposure durations
- Blue light correction
- Limiting cone angle
- Small and large sources
- Correction factor method for photochemical MPEs

Calculation Session 5 – Dual Limits

Laser Hazard Classification
- Concepts of hazard classification
- Limiting apertures
- Measurement apertures
- Current Federal classification

Calculation Session 6 – Classification by Federal Standard

IEC 60825-1-2007 hazard classification
- Time base
- Reference Points
- Extended source AELs
- Correction for multiple pulses

Calculation Session 7 – Classification by IEC 60825-1-2007

IEC 60825-1-2014 hazard classification
- Changes to extended source AELs
- Changes to correction for multiple pulses

Calculation Session 8 -- Classification by IEC 60825-1-2014

Day Three:

Outdoor Use of Lasers
- Direct beam hazards
- Diffuse and specular reflections
- Setting up buffer zones

Exposure at a Distance
- Beam expansion formulae
- Diffuse reflection calculations

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Calculation Session 9 –Beam Diameter and Diffuse Reflections

Nominal Ocular Hazard Distances
- Classical and alternate methods
- Effect of atmosphere
- Extended source lasers
- Use of telescopic viewing devices

Calculation Session 10 – NOHD and NOHD-M

Specular and Diffuse Reflections
- Hazards from flat glass and water
- Size and curvature of reflectors
- Extended diffuse sources
- Multiple wavelength analysis

Calculation Session 11 – Specular and Diffuse Reflections
ANSI Z136.1 classification (2014)
- intrabeam exposure
- Extended sources
- Multiple Pulse correction

Calculation Session 12 – ANSI Classification

Visual Interference
- Visual interference levels
- Visual interference flight zones
- Visual interference distances
- Elevation angle and atmospheric attenuation

Calculation Session 13 –Visual Interference Calculations