Easy Haz Professional LSO

LASER HAZARD ANALYSIS REPORT

Laser Description:

QCL laser

Manufacturer:	Daylight Solutions
Model Number:	TSL-41062-UT
Serial Number:	na
System Classification:	3B
Operating State:	na
Report ID:	1502238243
Date of Analysis:	02/23/2015
Laser Owner:	Tao, Hu
Laser Safety Officer:	Pennington, Scott
Laser Location:	ETC 6.208 ETC 6.208

LASER INPUT DATA

Wavelength:	6 um
Mode of Operation:	Continuous Wave
Average Power	2.2E-01 W
Pulse Duration:	na s
Pulse Repetition Rate:	na Hz
Group Duration:	na s
Group Repetition Rate:	na Hz
Exposure Duration:	1E+01 s
Successive Day Exposure:	No
Optically Aided Viewing:	No
Atmospheric Attenuation:	0 cm^{-1}
Beam Measurement Criteria:	($1/e^2$)
Beam Spatial Profile:	circular gaussian
Major Axis Diameter:	2.5E+00 mm
Major Axis Divergence:	5E+00 mrad
Major Axis M-Squared:	1.64
Minor Axis Diameter:	2.5E+00 mm
Minor Axis Divergence:	5E+00 mrad
Minor Axis M-Squared:	1.64
Intrabeam Observer Range:	5E-01 m
Focal Length of Lens:	na mm
Spatial Profile on Lens:	na
Major Diameter on Lens:	na mm
Minor Diameter on Lens:	na mm
Lens Observer Range:	na m
Fiber Optic Type:	none
MFD / NA:	na
Fiber Optic Observer Range:	na m
Diffuse Reflectivity:	100 %
Diffuse Viewing Angle:	0 deg
Beam Diameter on Target:	1E-01 mm
Diffuse Observer Range:	2.5E-01 m
Diffuse Exposure Duration:	6E+02 s

LASER SAFETY RESULTS

Intrabeam/Lens-on-Laser(LoL)/Fiber Exposure

Point Source Ocular MPE:	1E-01 W/cm^2
Worst Case Optical Density:	1.36 OD
OD at Intrabeam Obsr. Range:	1.29 OD
OD at Lens Obsr. Range:	na OD
OD at Fiber Optic Obsr. Range:	na OD
Skin MPE:	1E-01 W/cm^2
Times Skin MPE:	2.29E+01

NOHD/NHZ Values

Intrabeam Eye NOHD:	4.7E+00 m
Point Source Eye Dif Ref NHZ:	8.4E-03 m
Skin Dif Ref NHZ:	8.4E-03 m
Lens-On-Laser Eye NOHD:	na m
Fiber Optic Eye NOHD:	na m

Diffuse Reflection Exposure

Source Type:	Point
Ocular MPE:	1E-01 W/cm^2
Point Source Eye NHZ	8.4E-03 m
Extended Source Range:	na m
OD for Diffuse Obsr. Range:	0 OD
Fraction of Ocular MPE:	na
Skin MPE:	1E-01 W/cm^2
Times Skin MPE:	1.12E-03

OTHER CALCULATED VALUES

Average Power:	2.2E-01 W
Peak Pulse Power:	2.2E-01 W
Energy per Pulse:	2.2E+00 J
Duty Cycle:	1E+02 %
Average Power of Group:	na W
Pulses per Group:	na
Groups per Exposure:	na
Pulses per Exposure:	na
Major Diameter at Range:	3.5E+00 mm
Minor Diameter at Range:	3.5E+00 mm
Peak Irradiance in Eye LA:	1.96E+00 W/cm^2
Avg Irradiance in Eye LA:	1.96E+00 W/cm^2
C_A:	na
C_B:	na
C_C:	na
C_E:	na
C_P (Small Source RP only):	na

Notes:
for NeaSpec SNOM, microscopy, CW operation, 6000nm

Easy Haz LSO

LASER HAZARD ANALYSIS REPORT

Laser Description:

DPSS CW

Manufacturer:	Cobalt
Model Number:	Samba 532-400
Serial Number:	na
System Classification:	3B
Operating State:	na
Report ID:	1903715246
Date of Analysis:	03/7/2019
Laser Owner:	Li, Elaine
Laser Safety Officer:	Holcomb, RD
Laser Location:	Main EER 0.824

LASER INPUT DATA

Wavelength:	532 nm
Mode of Operation:	Continuous Wave
Average Power	4E-01 W
Pulse Duration:	na s
Pulse Repetition Rate:	na Hz
Group Duration:	na s
Group Repetition Rate:	na Hz
Exposure Duration:	2.5E-01 s
Successive Day Exposure:	No
Optically Aided Viewing:	No
Atmospheric Attenuation:	0 cm^{-1}
Beam Measurement Criteria:	($1/e^2$)
Beam Spatial Profile:	circular gaussian
Major Axis Diameter:	1E+00 mm
Major Axis Divergence:	1E+00 mrad
Major Axis M-Squared:	1.48
Minor Axis Diameter:	1E+00 mm
Minor Axis Divergence:	1E+00 mrad
Minor Axis M-Squared:	1.48
Intrabeam Observer Range:	5E-01 m
Focal Length of Lens:	na mm
Spatial Profile on Lens:	na
Major Diameter on Lens:	na mm
Minor Diameter on Lens:	na mm
Lens Observer Range:	na m
Fiber Optic Type:	none
MFD / NA:	na
Fiber Optic Observer Range:	na m
Diffuse Reflectivity:	100 %
Diffuse Viewing Angle:	0 deg
Beam Diameter on Target:	1E-03 mm
Diffuse Observer Range:	2.5E-01 m
Diffuse Exposure Duration:	6E+02 s

LASER SAFETY RESULTS

Intrabeam/Lens-on-Laser(LoL)/Fiber Exposure

Point Source Ocular MPE:	2.55E-03 W/cm^2
Worst Case Optical Density:	2.61 OD
OD at Intrabeam Obsr. Range:	2.61 OD
OD at Lens Obsr. Range:	0 OD
OD at Fiber Optic Obsr. Range:	0 OD
Skin MPE:	3.11E+00 W/cm^2
Times Skin MPE:	1.34E+00

NOHD/NHZ Values

Intrabeam Eye NOHD:	2E+02 m
Point Source Eye Dif Ref NHZ:	1.13E-01 m
Skin Dif Ref NHZ:	8E-03 m
Lens-On-Laser Eye NOHD:	0 m
Fiber Optic Eye NOHD:	0 m

Diffuse Reflection Exposure

Source Type:	Point
Ocular MPE:	1E-03 W/cm^2
Point Source Eye NHZ	1.13E-01 m
Extended Source Range:	na m
OD for Diffuse Obsr. Range:	0 OD
Fraction of Ocular MPE:	1E+00
Skin MPE:	2E-01 W/cm^2
Times Skin MPE:	1.02E-03

OTHER CALCULATED VALUES

Average Power:	4E-01 W
Peak Pulse Power:	na W
Energy per Pulse:	1E-01 J
Duty Cycle:	1E+02 %
Average Power of Group:	na W
Pulses per Group:	na
Groups per Exposure:	na
Pulses per Exposure:	na
Major Diameter at Range:	1.12E+00 mm
Minor Diameter at Range:	1.12E+00 mm
Peak Irradiance in Eye LA:	na W/cm^2
Avg Irradiance in Eye LA:	1.04E+00 W/cm^2
C_A:	1E+00
C_B:	4.4E+01
C_C:	na
C_E:	na
C_P (Point Source RP only):	na

Notes:
used as a 1028nm pump to a HIRO HG output of 206nm, and to an Orpheus OPA with a very large array of wavelength options

Easy Haz LSO

LASER HAZARD ANALYSIS REPORT

Laser Description:

DPSS Pump

Manufacturer:	Lightconversion
Model Number:	Carbide
Serial Number:	na
System Classification:	4
Operating State:	na
Report ID:	19037144649
Date of Analysis:	3/7/2019
Laser Owner:	Li, Elaine
Laser Safety Officer:	Holcomb, RD
Laser Location:	Main EER 0.824

LASER INPUT DATA

Wavelength:	1028 nm
Mode of Operation:	Repetitive Pulse
Energy per Pulse	4E-04 J
Pulse Duration:	2.9E-13 s
Pulse Repetition Rate:	1E+05 Hz
Group Duration:	na s
Group Repetition Rate:	na Hz
Exposure Duration:	1E+01 s
Successive Day Exposure:	No
Optically Aided Viewing:	No
Atmospheric Attenuation:	0 cm^{-1}
Beam Measurement Criteria:	($1/e^2$)
Beam Spatial Profile:	circular gaussian
Major Axis Diameter:	1.31E+00 mm
Major Axis Divergence:	1E+00 mrad
Major Axis M-Squared:	1
Minor Axis Diameter:	1.31E+00 mm
Minor Axis Divergence:	1E+00 mrad
Minor Axis M-Squared:	1
Intrabeam Observer Range:	5E-01 m
Focal Length of Lens:	na mm
Spatial Profile on Lens:	na
Major Diameter on Lens:	na mm
Minor Diameter on Lens:	na mm
Lens Observer Range:	na m
Fiber Optic Type:	none
MFD / NA:	na
Fiber Optic Observer Range:	na m
Diffuse Reflectivity:	100 %
Diffuse Viewing Angle:	0 deg
Beam Diameter on Target:	1E-03 mm
Diffuse Observer Range:	2.5E-01 m
Diffuse Exposure Duration:	6E+02 s

LASER SAFETY RESULTS

Intrabeam/Lens-on-Laser(LoL)/Fiber Exposure

Point Source Ocular MPE:	4.5E-03 W/cm^2
Worst Case Optical Density:	4.36 OD
OD at Intrabeam Obsr. Range:	4.36 OD
OD at Lens Obsr. Range:	0 OD
OD at Fiber Optic Obsr. Range:	0 OD
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

NOHD/NHZ Values

Intrabeam Eye NOHD:	1.5E+03 m
Point Source Eye Dif Ref NHZ:	5.3E-01 m
Skin Dif Ref NHZ:	na m
Lens-On-Laser Eye NOHD:	0 m
Fiber Optic Eye NOHD:	0 m

Diffuse Reflection Exposure

Source Type:	Point
Ocular MPE:	4.5E-03 W/cm^2
Point Source Eye NHZ	5.3E-01 m
Extended Source Range:	na m
OD for Diffuse Obsr. Range:	0.65 OD
Fraction of Ocular MPE:	1E+00
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

OTHER CALCULATED VALUES

Average Power:	4E+01 W
Peak Pulse Power:	1.38E+09 W
Energy per Pulse:	4E-04 J
Duty Cycle:	2.9E-06 %
Average Power of Group:	na W
Pulses per Group:	na
Groups per Exposure:	na
Pulses per Exposure:	na
Major Diameter at Range:	1.4E+00 mm
Minor Diameter at Range:	1.4E+00 mm
Peak Irradiance in Eye LA:	3.6E+09 W/cm^2
Avg Irradiance in Eye LA:	1.04E+02 W/cm^2
C_A:	4.5E+00
C_B:	na
C_C:	na
C_E:	na
C_P (Point Source RP only):	na

Notes:
used as a 1028nm pump to a HIRO HG output of 206nm, and to an Orpheus OPA with a very large array of wavelength options

Easy Haz LSO

LASER HAZARD ANALYSIS REPORT

Laser Description:

UV HG

Manufacturer:	Lightconversion
Model Number:	HIRO PH1Fx
Serial Number:	na
System Classification:	4
Operating State:	na
Report ID:	19037145617
Date of Analysis:	03/7/2019
Laser Owner:	Li, Elaine
Laser Safety Officer:	Holcomb, RD
Laser Location:	Main EER 0.824

LASER INPUT DATA

Wavelength:	206 nm
Mode of Operation:	Repetitive Pulse
Energy per Pulse	5E-08 J
Pulse Duration:	2.9E-13 s
Pulse Repetition Rate:	1E+05 Hz
Group Duration:	na s
Group Repetition Rate:	na Hz
Exposure Duration:	1E+02 s
Successive Day Exposure:	No
Optically Aided Viewing:	No
Atmospheric Attenuation:	0 cm^{-1}
Beam Measurement Criteria:	$(1/e^2)$
Beam Spatial Profile:	circular gaussian
Major Axis Diameter:	1E+00 mm
Major Axis Divergence:	1E+00 mrad
Major Axis M-Squared:	3.81
Minor Axis Diameter:	1E+00 mm
Minor Axis Divergence:	1E+00 mrad
Minor Axis M-Squared:	3.81
Intrabeam Observer Range:	5E-01 m
Focal Length of Lens:	na mm
Spatial Profile on Lens:	na
Major Diameter on Lens:	na mm
Minor Diameter on Lens:	na mm
Lens Observer Range:	na m
Fiber Optic Type:	none
MFD / NA:	na
Fiber Optic Observer Range:	na m
Diffuse Reflectivity:	100 %
Diffuse Viewing Angle:	0 deg
Beam Diameter on Target:	1E-03 mm
Diffuse Observer Range:	2.5E-01 m
Diffuse Exposure Duration:	6E+02 s

LASER SAFETY RESULTS

Intrabeam/Lens-on-Laser(LoL)/Fiber Exposure

Point Source Ocular MPE:	3E-05 W/cm^2
Worst Case Optical Density:	3.24 OD
OD at Intrabeam Obsr. Range:	3.24 OD
OD at Lens Obsr. Range:	0 OD
OD at Fiber Optic Obsr. Range:	0 OD
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

NOHD/NHZ Values

Intrabeam Eye NOHD:	2.06E+02 m
Point Source Eye Dif Ref NHZ:	1.78E-01 m
Skin Dif Ref NHZ:	na m
Lens-On-Laser Eye NOHD:	0 m
Fiber Optic Eye NOHD:	0 m

Diffuse Reflection Exposure

Source Type:	Point
Ocular MPE:	5E-06 W/cm^2
Point Source Eye NHZ	1.78E-01 m
Extended Source Range:	na m
OD for Diffuse Obsr. Range:	0 OD
Fraction of Ocular MPE:	1E+00
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

OTHER CALCULATED VALUES

Average Power:	5E-03 W
Peak Pulse Power:	1.72E+05 W
Energy per Pulse:	5E-08 J
Duty Cycle:	2.9E-06 %
Average Power of Group:	na W
Pulses per Group:	na
Groups per Exposure:	na
Pulses per Exposure:	na
Major Diameter at Range:	1.12E+00 mm
Minor Diameter at Range:	1.12E+00 mm
Peak Irradiance in Eye LA:	1.79E+06 W/cm^2
Avg Irradiance in Eye LA:	5.2E-02 W/cm^2
C_A:	na
C_B:	na
C_C:	na
C_E:	na
C_P (Point Source RP only):	na

Notes:
HG conversion to 206nm from 1028 pump

Easy Haz LSO

LASER HAZARD ANALYSIS REPORT

Laser Description:

Fang - NKT Photonics - 405 Pulsed

Manufacturer:	NKT Photonics
Model Number:	PIL040-FC
Serial Number:	EHS-BF8676-LAS5
System Classification:	3b
Operating State:	CW
Report ID:	2010613322
Date of Analysis:	10/6/2020
Laser Owner:	Bin Fang
Laser Safety Officer:	DeWayne Holcomb
Laser Location:	Main Campus EER 0.824

LASER INPUT DATA

Wavelength:	405 nm
Mode of Operation:	Repetitive Pulse
Peak Power	1.6E-01 W
Pulse Duration:	4.5E-11 s
Pulse Repetition Rate:	4E+07 Hz
Group Duration:	na s
Group Repetition Rate:	na Hz
Exposure Duration:	2.5E-01 s
Successive Day Exposure:	No
Optically Aided Viewing:	No
Atmospheric Attenuation:	0 cm^{-1}
Beam Measurement Criteria:	($1/e^2$)
Beam Spatial Profile:	circular gaussian
Major Axis Diameter:	5E-01 mm
Major Axis Divergence:	1.03E+00 mrad
Major Axis M-Squared:	1
Minor Axis Diameter:	5E-01 mm
Minor Axis Divergence:	1.03E+00 mrad
Minor Axis M-Squared:	1
Intrabeam Observer Range:	5E-01 m
Focal Length of Lens:	na mm
Spatial Profile on Lens:	na
Major Diameter on Lens:	na mm
Minor Diameter on Lens:	na mm
Lens Observer Range:	na m
Fiber Optic Type:	none
MFD / NA:	na
Fiber Optic Observer Range:	na m
Diffuse Reflectivity:	100 %
Diffuse Viewing Angle:	0 deg
Beam Diameter on Target:	1E-03 mm
Diffuse Observer Range:	2.5E-01 m
Diffuse Exposure Duration:	6E+02 s

LASER SAFETY RESULTS

Intrabeam/Lens-on-Laser(LoL)/Fiber Exposure

Point Source Ocular MPE:	2.55E-03 W/cm^2
Worst Case Optical Density:	0 OD
OD at Intrabeam Obsr. Range:	0 OD
OD at Lens Obsr. Range:	0 OD
OD at Fiber Optic Obsr. Range:	0 OD
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

NOHD/NHZ Values

Intrabeam Eye NOHD:	0 m
Point Source Eye Dif Ref NHZ:	9.6E-03 m
Skin Dif Ref NHZ:	na m
Lens-On-Laser Eye NOHD:	0 m
Fiber Optic Eye NOHD:	0 m

Diffuse Reflection Exposure

Source Type:	Point
Ocular MPE:	1E-04 W/cm^2
Point Source Eye NHZ	9.6E-03 m
Extended Source Range:	na m
OD for Diffuse Obsr. Range:	0 OD
Fraction of Ocular MPE:	1E+00
Skin MPE:	undefined W/cm^2
Times Skin MPE:	na

OTHER CALCULATED VALUES

Average Power:	2.88E-04 W
Peak Pulse Power:	1.6E-01 W
Energy per Pulse:	7.2E-12 J
Duty Cycle:	1.8E-01 %
Average Power of Group:	na W
Pulses per Group:	na
Groups per Exposure:	na
Pulses per Exposure:	na
Major Diameter at Range:	7.2E-01 mm
Minor Diameter at Range:	7.2E-01 mm
Peak Irradiance in Eye LA:	4.2E-01 W/cm^2
Avg Irradiance in Eye LA:	7.5E-04 W/cm^2
C_A:	1E+00
C_B:	1E+00
C_C:	na
C_E:	na
C_P (Point Source RP only):	na

Notes:
If we we treat the peak power of 160 mW as average power we can conservatively recommend an OD of 3 for laser eyewear protection.