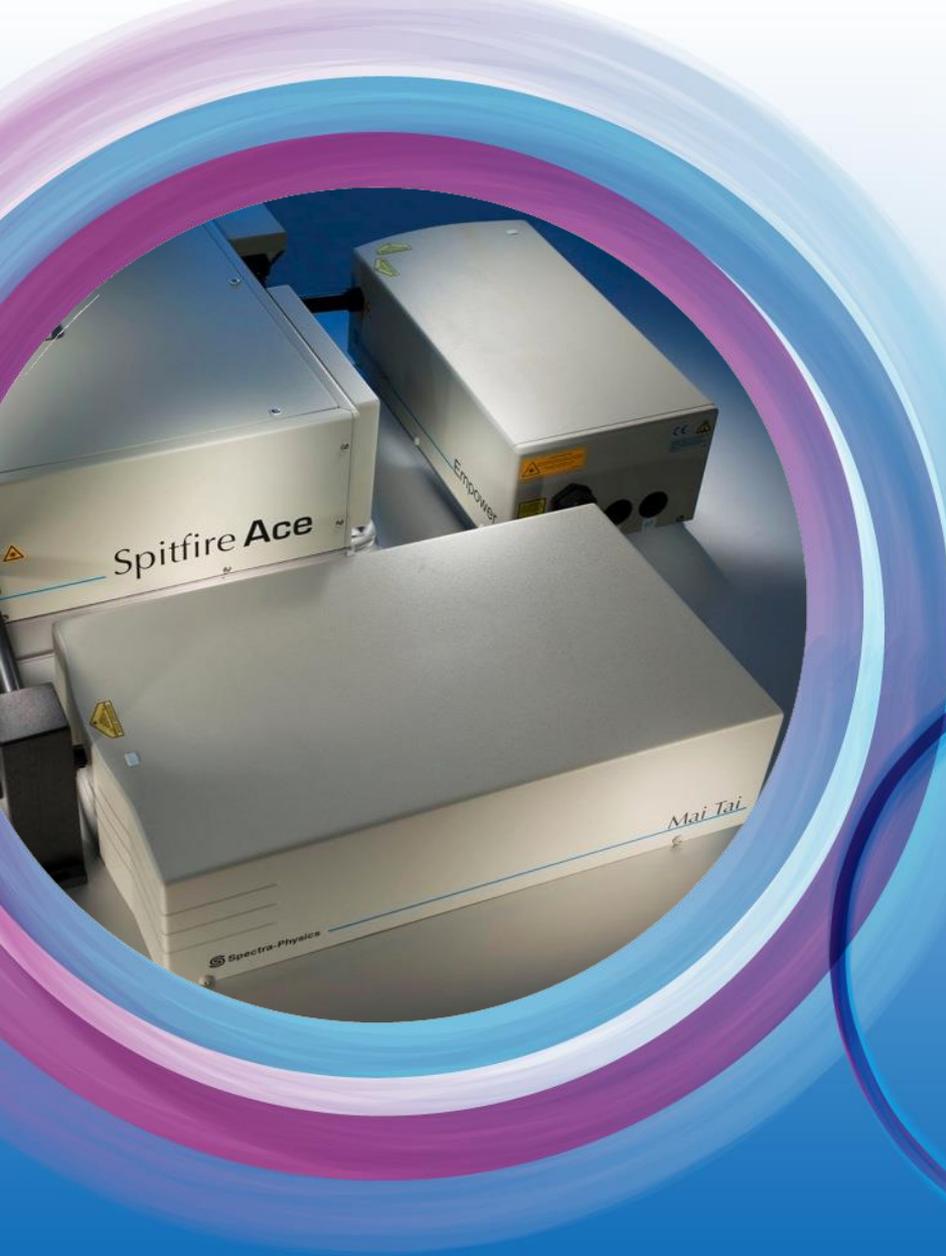




A Newport Company

Addressing Laser Safety in Manufacturing and R&D Environments

By David Marshall
Sr. Regulatory Compliance
Engineer & Laser Safety Officer
Spectra-Physics, a Newport
Corporation Company



Session Objectives & Agenda

-  To provide an overview of actions and efforts taken by Spectra-Physics to Incorporate Laser Safety into our Laser Manufacturing Production and Research and Development Activities.
-  Share actions that we have taken, as a Laser Manufacturer, to provide the Safest Environment we can, for Our Laser Manufacturing Personnel, and Our Research and Development Engineers and Technicians.
-  Reinforce the Importance of Near Miss and Accident Reporting in our Facilities
-  Summarize, Questions & Open Discussion Time

Actions Taken for New Employees

Although Laser Eye Exams are not Mandatory in the ANSI Z136.1:2014 Standard for the Safe Use of Lasers, due to Employee turn over, and the Fact that personnel in the Laser business tend to work for multiple Laser Companies over the course of their Careers, Spectra-Physics requires All New “Hands On” Laser Employees to get a Baseline Laser Eye Exam.

Laser Eye Examinations are also Required any time there is even a suspected Laser Eye Exposure, AND an Exit Eye Exam is Required when an Employee leaves the Company.

There have been several occasions where our Baseline Laser Eye Exams have Identified preexisting laser damage, and/or identified medical conditions such as Macular Degeneration, or onset of Diabetes, that the Employee was not aware of.

Actions Taken for New Employees

All New “Hands On” Laser Personnel are required to take a Minimum Of Two Hours of Laser Safety Training, either Presented in a Power Point based classroom Presentation given by Myself, or to review the Laser Safety Power Point Presentation alone.

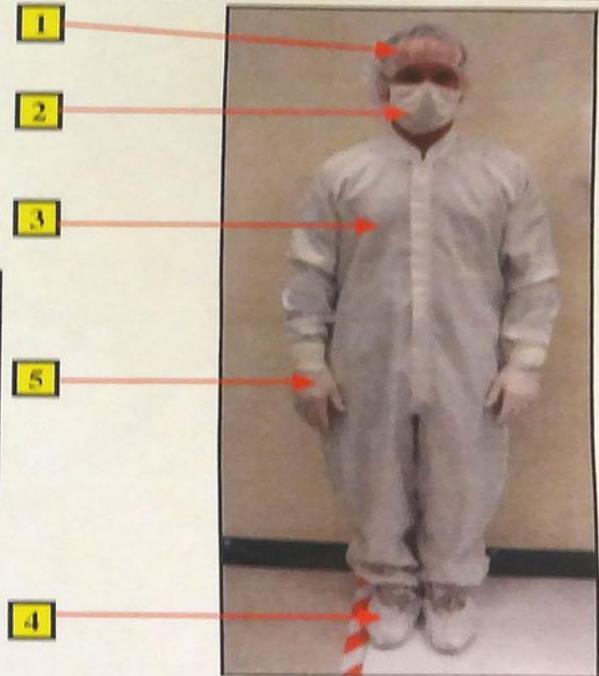
Upon completion of reviewing the Laser Safety Presentation, all “Hands On” Laser Employees are required to take a Laser Safety Test, which gets graded and filed as proof of Training.

In addition to Laser Safety Training, all New Employees involved in Manufacturing of our Lasers are required to Have Clean Room Training, which includes steps for donning and doffing of Cleanroom Clothing, which in addition to enhancing the cleanliness and reducing Human particulate contamination, significantly reduces skin exposure to Ultraviolet Laser Radiation that could occur in the Manufacturing Process.

Clean Room Gowning Procedure

MS#: EQ10111	Page: 2 of 2	Revision: B	Bill of Materials			
GOWNING - CLEAN ROOM			Find	Part #	Qty	Description
Operation #: 100			1	5405-0001	1	BONNET, 1 SIZE FITS ALL
Process ID: GOWNING - CLEAN AREA			2	5405-0019	1	FACE MASK
WORK CONTENT VERIFY ▲ TQC			3		1	CLEAN JUMPSUIT
WORK CONTENT VERIFY ▲ TQC			4	5405-0024	2	SHOE COVER, POLY, WHT, 4 MIL, LG
WORK CONTENT VERIFY ▲ TQC			5	SEE MATRIX	2	GLOVES

PART NUMBER	DESCRIPTION
90003104	GLOVE, NITRILE, 6MIL, CLASS10, XS
90003105	GLOVE, NITRILE, 6MIL, CLASS10, SML
90003106	GLOVE, NITRILE, 6MIL, CLASS10, MED
90003107	GLOVE, NITRILE, 6MIL, CLASS10, LRG
90003108	GLOVE, NITRILE, 6MIL, CLASS10, XL
90003109	GLOVE, NITRILE, 6MIL, CLASS10, XXL



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Key Symbols Used in Operational Method Sheets

-  **TQC:** Total Quality Check, a process verification step that is critical to the production process. A TQC requires a second person to verify the accuracy of the completed step. This type of instruction is identified by a red triangle.
-  **Verify:** Indicates an important production process that requires a double-check to ensure conformance to requirements. This can be done by the same person who performed the work. This type of instruction is identified by a blue circle.
-  **BoM Item:** Bill of Materials Item, a consumable item used in the build process. This type of instruction is identified by a number within a green hexagon corresponding to an item on the Bill of Materials list.

Process Icons Used in Operational Method Sheets



Use caution against burns around hot plate, oven, heat gun or anywhere where burn danger exists.



Use specified chemical to clean.



Caution Electrical Hazard.



Use c-clamp to secure.



Heed all warning signs posted in and around work areas.



Visually inspect or verify as indicated.



Wear laser safety glasses when working with or around any lasers or UV light sources. Check the laser safety glasses to make sure they are rated for the laser wavelength and/or UV light you are using.



Roller used to mix epoxy.



Wear safety glasses when working with small parts, epoxy, chemicals, soldering or cutting material that may fly into the air.



Use IDC tool to install wires.



Listen for audible sound.



Punch ball mount holes with tool. Set tool (T129-0452) perpendicular to plane of hole being punched.

Process Icons Used in Operational Method Sheets



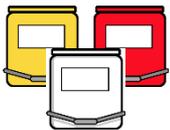
Make sure Microscope is focused properly. Working for extended periods of time with an improperly focused microscope can cause eye strain, headaches, and/or nausea.



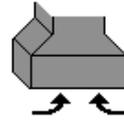
Each person dealing with lasers must receive a laser eye exam prior to commencing work. Your supervisor and the EH&S department will ensure compliance.



Refer to the appropriate material safety data sheets (MSDS) for complete chemical safety information. Can be obtained from the Environmental Health and Safety Department.



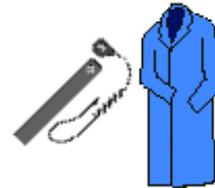
Dispose of all solvent soaked and/or contaminated debris (i.e., swabs, rags) in the appropriately marked container.



Handle chemicals only under the designated chemical hood(s).



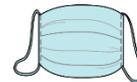
Observe precautions for handling Electrostatic Sensitive Devices.



Wear ESD wrist strap and ESD smocks in all areas where signs are posted.



Wear gloves during assembly process.



Wear mask when handling material.

Example of Operational Method Sheets used in Manufacturing

Operational Method Sheets and Safety

- At Spectra Physics, we build each laser model using “Operational Method Sheets”. As we release new models, we are incorporating safe practices in the documentation of how the lasers are built.

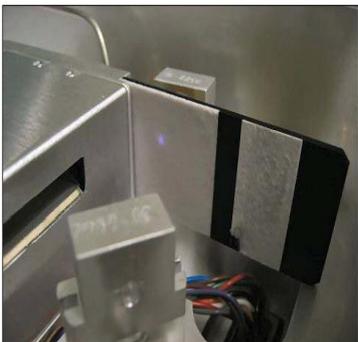
In this example the technician knows to wear gloves and safety eyewear in this operation

Page: 2 of 207		Revision: E	
Method Sheet #: 90037496		Operation #: 700	
Product #: ICSHG-15-23, FRU ICSHG-15-23			
REFERENCE DOCUMENTS			
DOC#	DESCRIPTION		
DEFINITIONS			
TERM	DESCRIPTION		
Bill of Material	List of items used in the procedure, including components, tooling, etc.		
Method Sheet	A step by step pictorial work instruction that includes text boxes where clarification is needed. There are two types of method sheets, one for product instruction and one for equipment operation.		
TQC	Total Quality Check, a verification of a process step that is critical to the production process and requires more than a simple verify. This type of instruction is identified by a number outlined by a red triangle.		
Verify	A check of work done. This type of instruction is identified by a number outlined by a blue circle.		
Work Content	Components or processing which adds value to the product. This type of instruction is identified by a number outlined by a yellow square.		
Operation#	Operation station number.		
M.E.	The manufacturing engineer is responsible for the operation described and for addressing technical questions about method sheets. The M.E. is also responsible for the release and revision of method sheets. Only the M.E. has authority to change released method sheets.		
N/A	Not Applicable		
SUPPLIES, MATERIALS, AND EQUIPMENT			

SAFETY, PROCEDURAL, and PRECAUTION ICONS

-  Install hardware in this order.
-  Torque hardware to specified value.
-  Observe precautions for handling Electrostatic Sensitive Devices.
-  Wear gloves during assembly process.
-  Wear laser safety glasses when working with, or around any lasers or UV light sources. Check the laser safety glasses to make sure they are rated for the laser wavelength and/or UV light you are using.
-  Use Microscope to check and inspect where indicated.

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MIS#: 90037496	Page: 51 of 207	Revision: E	Bill of Materials			
Product: ICSHG-15-23, FRU ICSHG-15-23			Find	Part #	Qty	Description
Operation #: 700						
Process ID: VERIFY CONCENTRIC BEAM THRU YLF ROD						
 WORK CONTENT  VERIFY  TQC						
						
<p>1. Verify alignment beam is concentric through YLF rod. Repeat previous 8 pages if necessary.</p> <div style="display: flex; justify-content: space-around;">   </div>						
			<p style="text-align: right; font-size: x-small;">Confidential – SP SSL Proprietary</p>			

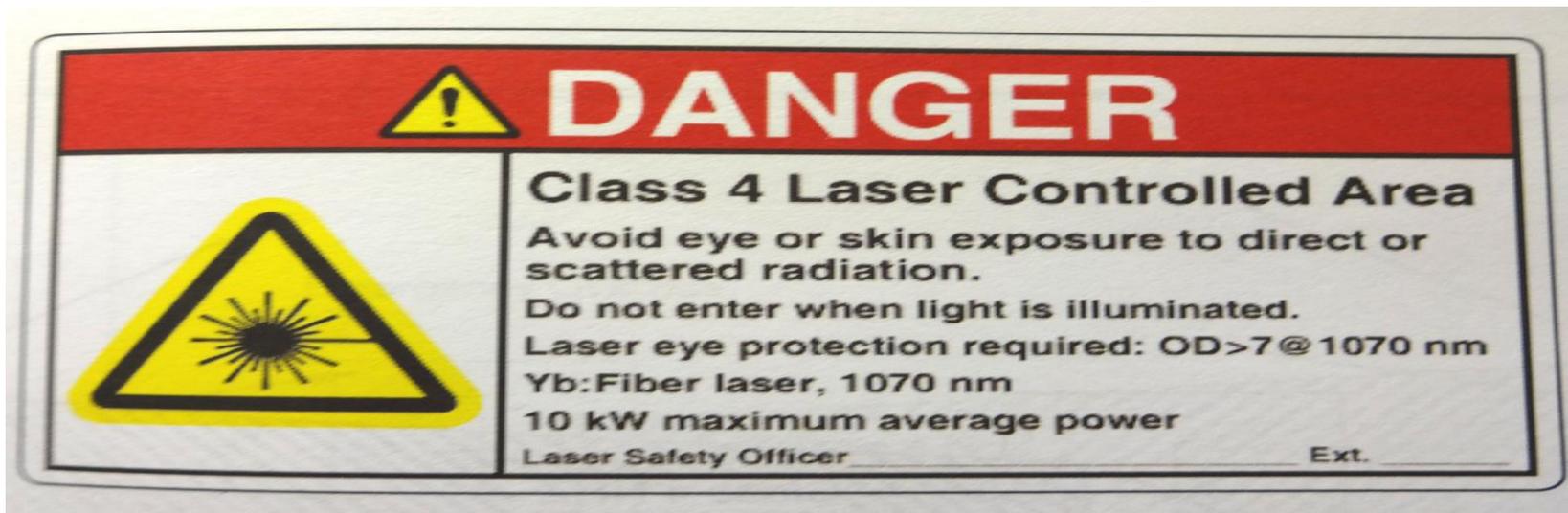
Laser Lab Entry Control Devices

Laser Manufacturing, Laser Assembly, and Test Laboratories have either a key board, key lock, or a card key reader to control access to our Laser Labs to only Trained Personnel. Examples of these Controlled Access Devices are shown Below.



Class 4 Laser Controlled Area Warning Sign

In addition to the ANSI Z136.1 Information required for Laser Area Warning Signage, in Laser Controlled Areas, I have added Names and Phone Numbers for Emergency contact information, and the minimum Optical Density requirements for Laser Safety glasses. I am currently in the process of converting our 25+ Class 4 Laser Controlled Area Danger Warning Signs to the ANSI Z535.2 Design, shown in the ANSI Z136-1:2014 Standard on Page 97, and below.



Class 4 Laser Controlled Area Warning Sign

Site L SO: David Marshall Ex. 980-5564, DL SO: Joe Blow Ex. 980-XXXX



DANGER



**Visible and/or invisible Laser Radiation —
Avoid Eye and Skin Exposure to
Direct or Scattered Radiation**

Emergency Contacts: Contact ALL

Clark Kent (408) 980-XXXX
Bruce Wayne (408) 980-XXXX
Peter Parker (408) 980-XXXX
Bruce Banner (408) 980-XXXX

FANTASY LAB

Min. O.D.

520nm,	100fs	8 Watts	6.8
527nm	100-500ns	80 Watts	7.8
532nm	CW	30 Watts	4.5
600-1300nm	70fs	4 Watts	6.5
750-850nm	20fs-2ps	10 Watts	7.2
1040nm	>150fs	12 Watts	7.2



Class 4 Laser

Laser Safety Glasses Required

Laser Lab Standard Operating Procedure for Safety

Laser Lab SOP1.doc (Protected View) - Microsoft Word

Protected View Editing this file type is not allowed due to your policy settings. Click for more details.

Newport

Laser Lab Standard Operating Procedures for Safety

The following are the Standard Operating Procedures for Safety for the laser laboratories or work areas of Newport Corporation. For any other product or project specific safety requirements for the various operations that occur in these labs, contact your Supervisor or Manager, the project/product manager or engineer or the facility Laser Safety Officer. **These apply to all employees and visitors of Newport Corporation:**

- Eye protection is to be worn for lasers operating at _____ and above. Always check that eyewear is the appropriate type for the laser wavelengths and UV light involved.
- Read all necessary information on the laser that you are working with, **prior to any operation.**
- Never deliberately look into the path of a laser.
- Remove all unnecessary reflective objects from the work area (i.e. tools, jewelry).
- When not in use, lasers are to be shut/locked down and stored to prevent unauthorized use.
- Prior to operation, all appropriate safety signs are to be posted outside lab.
- Always check that doors are closed, outside warning lights activated and any window coverings are in place before laser is put in operation.
- Any repair, service or maintenance procedures are to be performed following OSHA & Newport Lockout/Tagout procedures for controlling any type of hazardous energy (laser, electrical, gas, water, etc...) and only by trained and authorized employees.
- Gloves and safety glasses are to be worn for the use of Acetone and Isopropyl Alcohol and any other chemical in the lab operations (consult MSDS for details).
- Any soldering is to only be done at the work station designed for that purpose.
- Always check lab controls/gauges for gas, water, electricity, and air **before and after** use for any signs of severe wear or damage. Report any needed repairs to your Supervisor, Manager or Facilities Department.
- Report any injuries **IMMEDIATELY** to the closest Supervisor or Manager. For any severe or life threatening situations, call "9-911" to notify local Emergency Responders.

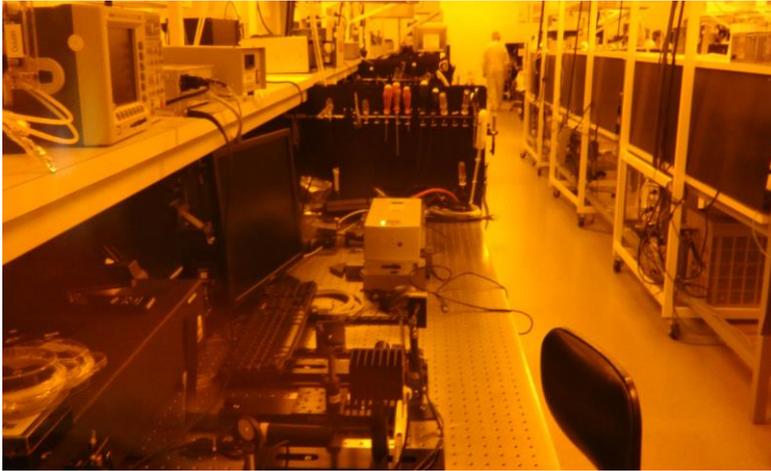
Page: 1 of 1 Words: 314

9:00 AM
Friday
6/14/2013

This is a basic laser safety SOP example used at Newport sites

Other SOPs can be very specific to product & operational processes, such as in the Operational Method Sheets used at Spectra-Physics to display how our Lasers are Manufactured

Laser Lab & Work Area Requirements



Laser Work Stations as Viewed thru Laser Filter Sheet from hallway

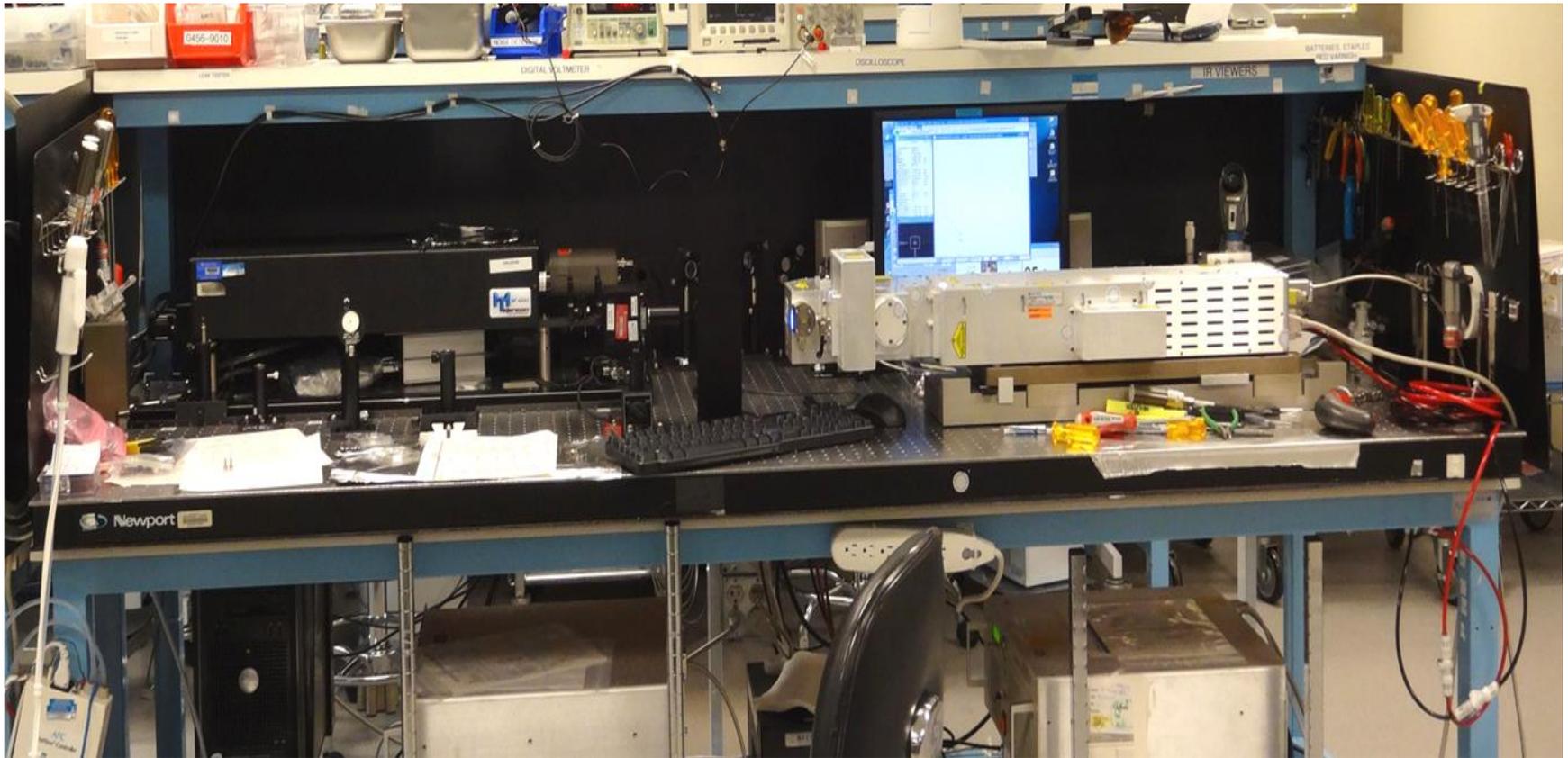


- Typical requirements found in Spectra-Physics Laser Labs & Manufacturing work areas
- Clean rooms – eliminating or minimizing airborne contaminants helps reduce beam scatter risks, and damage to laser optics
- Laser Filtered Viewing windows into large work areas for monitoring worker safety, and Visitor Viewing of the Manufacturing Processes
- Engineering controls such as interlocks, EPOs, UV and IR Viewers, beam blocks, barriers, Laser Curtains, etc.
- Documented SOP's and Operational Method Sheets supporting engineering controls in place
- PPE such as laser glasses, gowns, smocks, gloves, etc.
- Restricted access for safety & security requirements
- Portable or fixed protective enclosures
- Auditing for laser & general safety hazards – internal & external resources
- Laser inventories
- Appropriate signage at labs & work areas
- Hazardous waste collection areas

Laser Manufacturing Work Stations

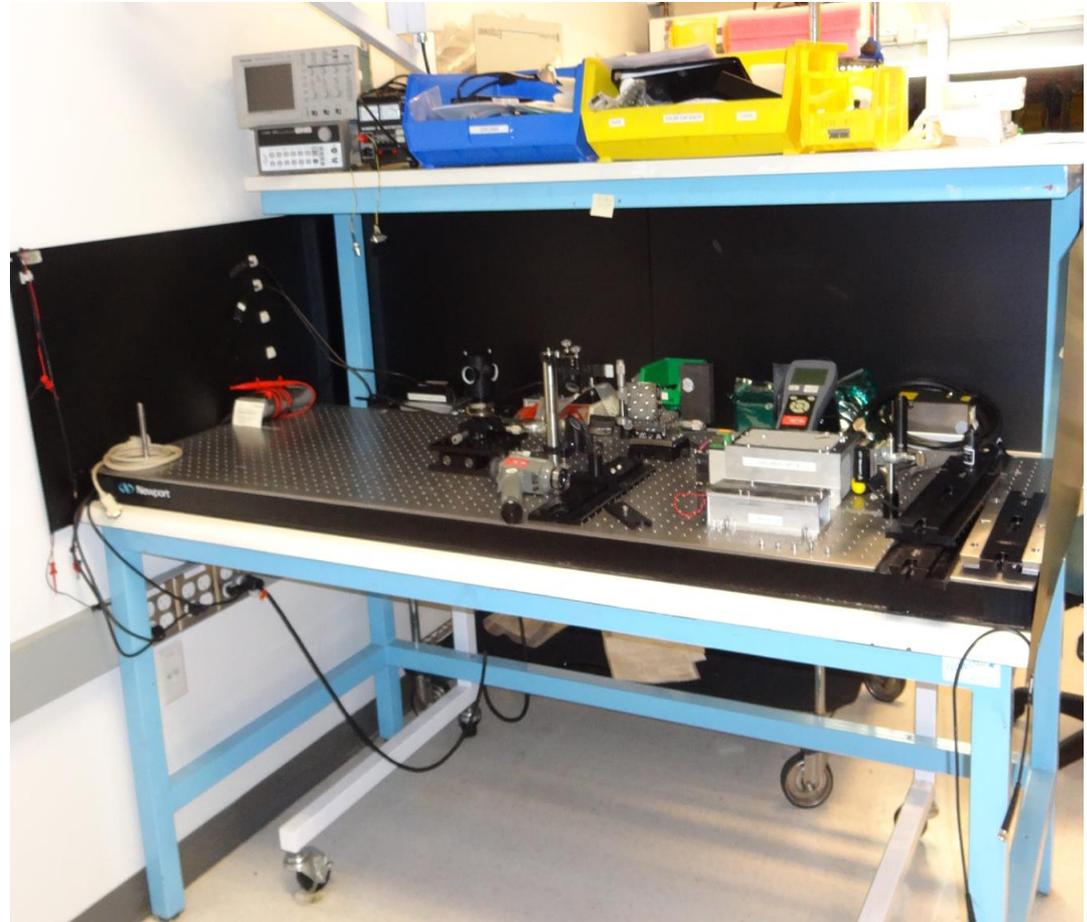
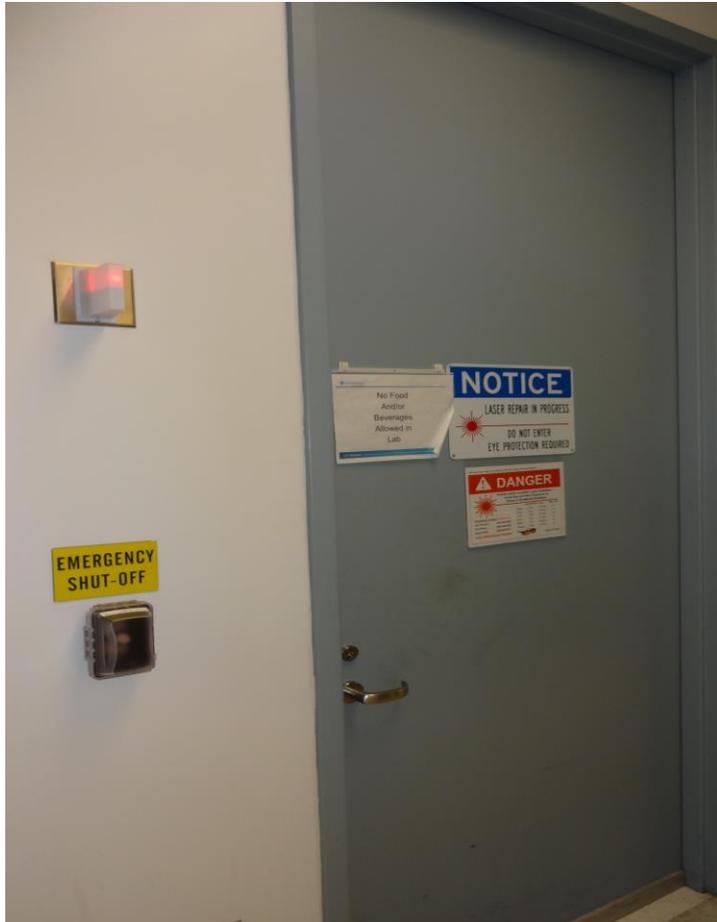
Laser Manufacturing Work Stations are generated for Specific Laser Models, and set up to insure that all the beams generated during the Manufacturing Process are contained within the Work Station.

Each of These Work Stations are Equipped with All the Tools, Beam Diagnostic Equipment necessary to produce a specific Model of Laser , and a computer to display the Manufacturing Method Sheets



Laser Servicing Work Stations

Lasers Returned to Spectra-Physics for Upgrade or Repair are brought into our Service Lab, which has all the Same Safety Features as our Manufacturing and Research and Development Labs. Warning Lights, Laser Area Controlled Warning Signs, and Emergency Power Off Buttons both inside and outside the Lab





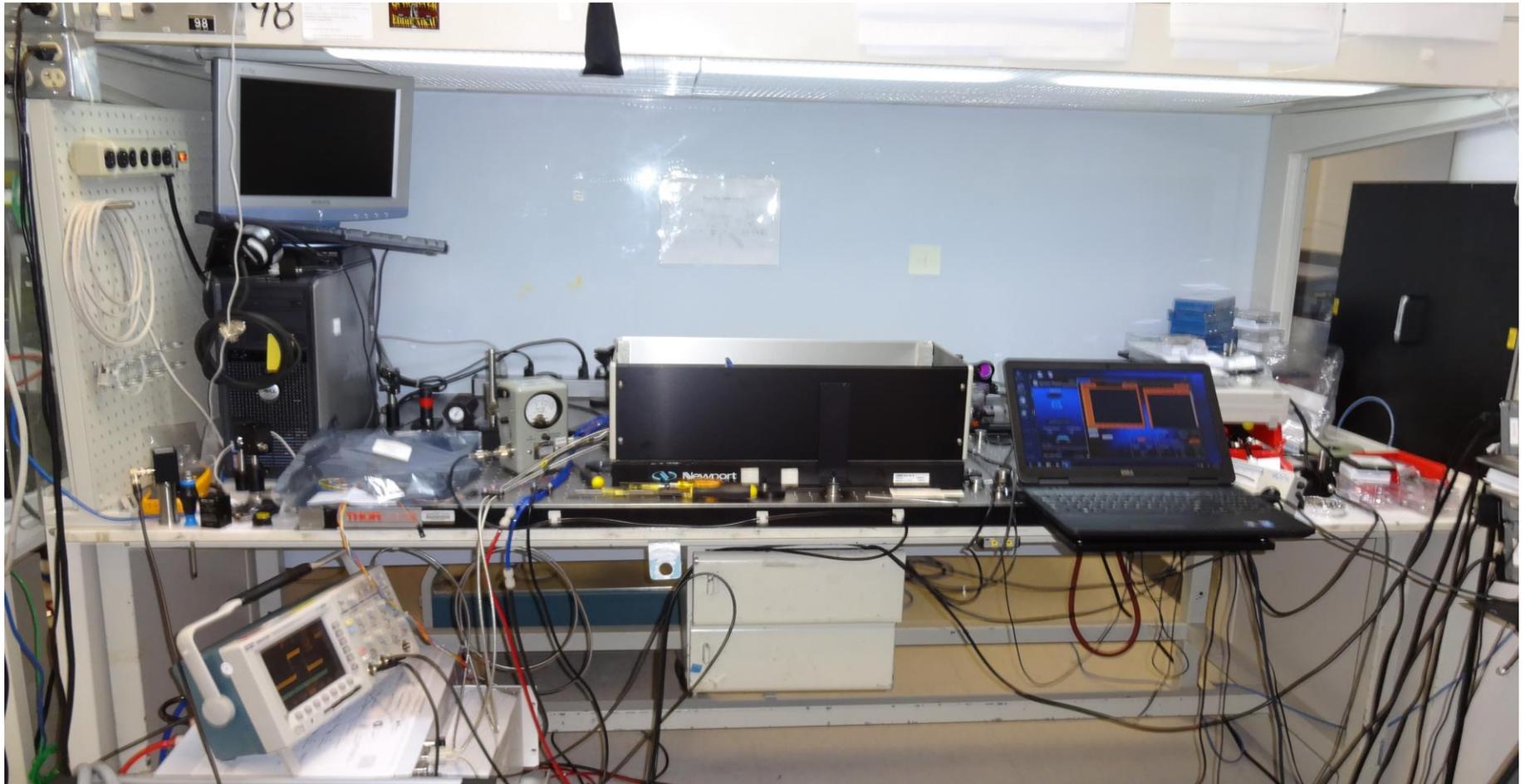
Research and Development Labs

Research & Development Labs present a unique challenge, as Laser Cavity Designs are assembled on open “Breadboards” where all transmitted and reflected beams must be accounted for. Additionally, we set up these labs with Laser beam free entry ways, where Laser Eyewear and gowning materials are located.



Research and Development Labs

This example is fairly Typical example of the set-up of a New Laser System in the Design Phase. To protect I P the laser “Cavity Layout” is covered.



Near Miss and Laser Accident Investigation and Reporting

§ 1002.20 Reporting of accidental radiation occurrences.

(a) Manufacturers of electronic products shall, where reasonable grounds for suspecting that such an incident has occurred, immediately report to the Director, Center for Devices and Radiological Health, all accidental radiation occurrences reported to or otherwise known to the manufacturer and arising from the manufacturing, testing, or use of any product introduced or intended to be introduced into commerce by such manufacturer. Reasonable grounds include, but are not necessarily limited to, professional, scientific, or medical facts or opinions documented or otherwise, that conclude or lead to the conclusion that such an incident has occurred.

(b) Such reports shall be addressed to the Center for Devices and Radiological Health, ATTN: Accidental Radiation Occurrence Reports (HFZ-240), Office of Communication, Education, and Radiation Programs, 9200 Corporate Blvd., Rockville, MD 20850, and the reports and their envelopes shall be distinctly marked "Report on 1002.20"

and shall contain all of the following information where known to the manufacturer:

- (1) The nature of the accidental radiation occurrence;
- (2) The location at which the accidental radiation occurrence occurred;
- (3) The manufacturer, type, and model number of the electronic product or products involved;
- (4) The circumstances surrounding the accidental radiation occurrence, including causes;
- (5) The number of persons involved, adversely affected, or exposed during the accidental radiation occurrence, the nature and magnitude of their exposure and/or injuries and, if requested by the Director, Center for Devices and Radiological Health, the names of the persons involved;
- (6) The actions, if any, which may have been taken by the manufacturer, to control, correct, or eliminate the causes and to prevent reoccurrence; and
- (7) Any other pertinent information with respect to the accidental radiation occurrence.

c) If a manufacturer is required to report to the Director under paragraph (a) of this section and also is required to report under part 803 of this chapter, the manufacturer shall report in accordance with part 803. If a manufacturer is required to report to the Director under paragraph (a) of this section and is not required to report under part 803, the manufacturer shall report in accordance with paragraph (a) of this section. A manufacturer need not file a separate report under this section if an incident involving an accidental radiation occurrence is associated with a defect or noncompliance and is reported pursuant to § 1003.10 of this chapter.

Low O.D. Alignment Laser Safety Glasses

With Laser Alignment being the highest cause of accidental Laser Eye Exposure, Spectra-Physics, allows the use of Low O.D. Alignment Laser Safety Glasses, but only after the Employee requesting Alignment Eyewear consults with the Laser Safety Officer and completes the form below, to insure they understand the risk associated with their use.

ALIGNMENT LASER SAFETY GLASSES REQUEST FORM

- Must be signed by employee and returned to David Marshall
- A critical component of laser activities is laser beam alignment. This activity is the central point of a large percent age of unintended laser eye exposures. One of the major contributing factors is not wearing protective eyewear. This problem centers on the issue of beam visibility and eyewear blocking that beam. To combat this Spectra-Physics Laser Safety Program promotes the use of remote viewing (cameras, etc) and engineering controls. When that is not feasible the use of alignment eyewear is preferred over no eyewear being worn.
- Alignment eyewear is an option for use with visible beams and gives partial protection & visibility for beam observation from diffuse or attenuated reflections, but not full protection from the direct beam. Laser Safety Officer approval for the use of alignment eyewear must be renewed annually, based on an evaluation of the conditions by the LSO. The following criteria will be used as guidance in determining whether alignment eyewear is appropriate for particular circumstances, and for selecting the appropriate eyewear OD:
 - (1) Protection from stray reflections from uncoated surfaces, typically ~4% of the direct beam. OD reduction ~1.4
 - (2) Protection from diffuse scatter at >0.5m observation distance. OD reduction ~4-5
 - (3) attenuation of direct beam below Class 3B level
 - (4) Protection provided by beam blocks and enclosures
- Alignment specific eyewear:
 - NOIR Filter YDA W/ O.D. of 1.5 @ 532 nm and a VLT of 9.1% (Brown Lens)
- Alignment specific controls (to be completed by user):
 - [Examples: reduce output, use of ND filters, use of Iris, use of beam enclosures, remote viewing]

Low O.D. Alignment Laser Safety Glasses

- EXAMPLE:
- The alignment eyewear (specified above) will provide adequate protection against diffuse reflections of laser beams (from matte surfaces). However, it will not protect users against direct viewing of laser beams or some specular reflections. The following alignment conditions must be carefully followed to avoid the potential for eye injury:
- Alignment eyewear is to be used only during 'fine' beam adjustments, with as much of the laser beam path enclosed as possible to eliminate the risk of specular reflections.
- With alignment eyewear, the beam may be viewed only as a diffuse reflection (from a matte surface, at a distance >0.5 m), or with remote viewing instruments.
- Alignment eyewear will not be used when inserting optics into the beam path, since the OD is not sufficient to protect against specular reflections (even from uncoated surfaces).
- Beam blocks and enclosures must be used to terminate all stray reflections when alignment eyewear is to be used.

Alignment eyewear approval

-
- As Spectra-Physics Laser Safety Officer I approve the use of laser alignment eyewear for Low Power Laser Alignment ONLY. Alignment Laser Safety Glasses SHALL NOT be worn as Personnel Protective Equipment during ANY non-alignment operations !
-
- I, _____ do here by acknowledge that I understand that
- (Employee Signature)
- the Alignment Laser Safety Glasses provided DO NOT provide Full Protection from High Power Laser Beams, and that I will use the Alignment Laser Safety Glasses provided for Low Power Visible Laser Alignment Only.
-
-
- Prior to the use of alignment eyewear the user must check for stray beams and take all practical steps to reduce the intensity of the laser beam(s).
-
-
- Approval granted on _____, expires one year from this date.
-
- _____
- David Marshall, Laser Safety Officer, Spectra-Physics
-

Field Service Engineer Laser and Safety Training

SPL Field Service EHS Training Letter 0714.pdf - Adobe Acrobat Pro

File Edit View Document Comments Forms Tools Advanced Window Help

Create Combine Collaborate Secure Sign Forms Multimedia Comment

2 / 2 71.7% Find

 Spectra-Physics
A Newport Corporation Brand

July 30, 2014

XXXX XXXX
XXXX

Dear XXXX,

This letter is sent to confirm the Environmental, Safety and Health training for Mr. XXXX XXXX, our Field Service Engineer.

Spectra-Physics Lasers provides annual training for our Field Service personnel on various Environmental, Safety and Health topics to comply with local, state and federal regulations. This training is required prior to performing any field service for our customers.

Training subjects and applicable regulations:

1) 1910.331 **Safety Related Work Practices** - topics covered:
Process Safety Management of Highly Hazardous Chemicals (1910.119)
Flammable and Combustible Liquids (1910.106)
Toxic and Hazardous Substances (1900.1000)
Personal Protective Equipment: Eye and Face Protection (1910.133)
Safety Color Code for Marking Physical Hazards (1910.144)
General Requirements for all Machines (Point of Op Guarding) 1910.212

Awareness Level Safety Overview
Occupational Noise Exposure (1910.95)
Emergency Response (1910.120)
Respiratory Protection (1910.134)
Confined Space (1910.146)
Blood Borne Pathogens (1910.1030)
Hazard Communication (1910.1200)
Storm Water Pollution Prevention Program

 Spectra-Physics
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Training subjects and applicable regulations (cont.)

2) 1910.101 Compressed Gases (General Requirements)
3) 1910.147 Control of Hazardous Energy (Lock Out / Tag Out)
4) 10CFR851 DOE (Worker Safety and Health Program)
5) ANSI Z136.1 Laser Safety Training
6) Power Supply and Laser Head Electrical Safety training.
(Newport / SPL generated training program under IIPP)

Information for the programs used to train S-P Field Service Personnel was obtained from:

ANSI Z136.1
10 CFR 851 -- (DOE Worker Safety and Health Program)
29 CFR 1910.000 to 1910.1200
CAL/OSHA GISO Title 8 Section 3203 (IIPP)
ANSI Z136.1
EPA - Clean Water Act - Non-Point Source - SWPPP.

For further information, please contact me directly.

Kerry Diaz
Service Director
International/North America Lasers Division

Spectra-Physics
A Newport Brand
3635 Peterson Way.
Santa Clara, CA 95054
Office Phone: (408) 9980-5741
Cell: (510) 821-2325
Email: kerry.diaz@newport.com

Food for thought from today's Presentation:

Spectra Physics has a very good overall safety performance record throughout it's 50 Plus Years of Operation

However, that does not happen without the support, involvement & dedication of our Management, Supervisors, Team Leaders and Employees !

Laser Safety Challenges are always going to be there, and mistakes have been made – The best thing to do is to learn from them! Overall Safety is all about continuous improvement in our Manufacturing Processes and Procedures, and Research and Development Activities

Questions or Comments?

Thank You for your attention and participation!