Newport
Experience | Solutions

Laser Safety Lessons Learned at Newport/Spectra Physics

DOE Laser Safety Officer Workshop - NIST Boulder, CO

September 10-12, 2013

Developed by Newport/SP Team

Dave Marshall

Kerry Diaz

Joe Juenemann

William Maloney

Al Roth

Session Objectives & Agenda

- Provide an overview of laser safety management experiences at Newport Corporation & Spectra Physics operations
- Share some of the various challenges, successes & “lessons learned” supporting laser & general safety in the workplace – whether at Newport or customer locations
- Reinforce the importance of injury prevention & the related costs to our employees and organizations
- Summarize, Questions & Open Discussion Time

U.S. Manufacturing Locations – Where are lasers used?

Spectra-Physics
Santa Clara, CA
- Solid State Lasers
- Gas Lasers

Ophir Optronics
Sites in MA & UT

ILX Lightwave
Bozeman, MT

Newport Rochester, NY
(Richardson Gratings)
- Gratings test & measurement

Newport Stratford, CT
(Oriel)
- UV light sources

Newport
Precision Optics
Irvine, CA
- Optics surface test & measurement

Newport Irvine, CA
- OEM customers
- Tech Applications Center

Newport Billerica, MA
(MRSI)
- Catalog & OEM Equipment
- Laser Based Disk Texturing Systems

Newport Franklin, MA
(Corion Filters)
- Filters test & measurement

International Locations – Where lasers used?

Spectra-Physics GMBH
Darmstadt and Berlin
- Sales & Service
- Laser R&D

Hi Q
Rankweil Austria

Ultrafast Medical Lasers

Spectra-Physics KK
Tokyo & Osaka, Japan
- Sales & Service

Ophir Optronics
Israel & Romania

Newport/Micro-Controle
Beaune, France
- Precision Motion Systems
- Opto-Mechanical Components

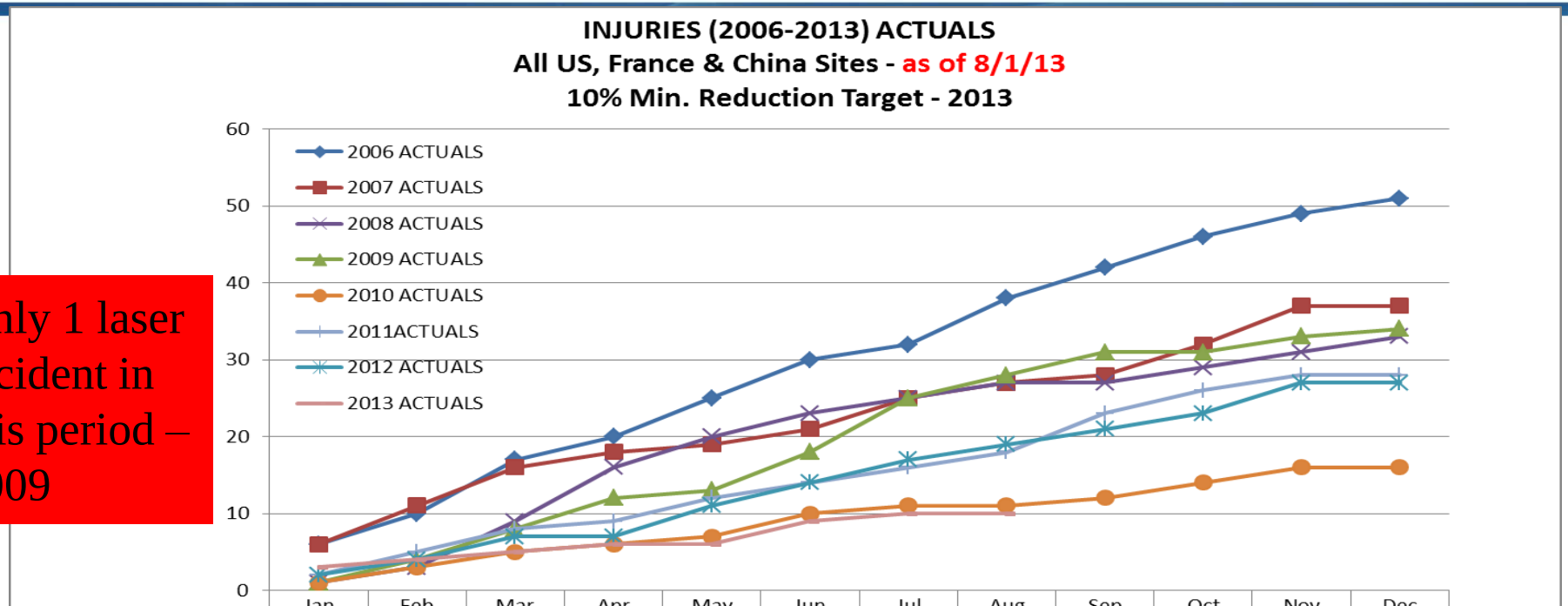
Newport/Micro-Controle
La Bouline, France
- Precision Machining

Newport- OET
Wuxi, PRC
- Integrated Mfg.
- Supplier Sourcing
- In-house Service

Newport Taiwan
Taipei, Taiwan
- Sales & Service

All of these sites use lasers in one fashion or another

'06-'13 Total Injuries – All Newport as of 8/1/13

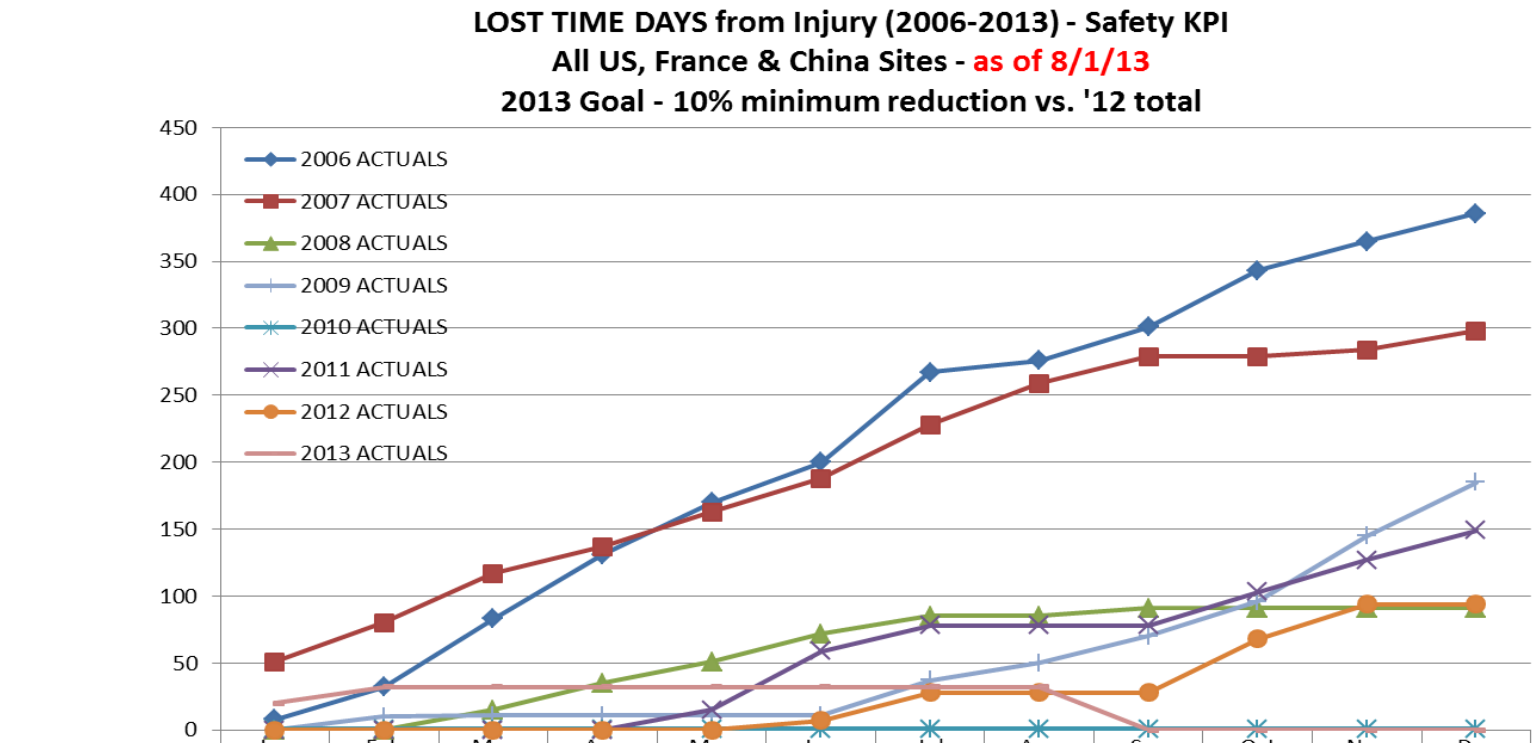


	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006 ACTUALS	6	10	17	20	25	30	32	38	42	46	49	51
2007 ACTUALS	6	11	16	18	19	21	25	27	28	32	37	37
2008 ACTUALS	1	3	9	16	20	23	25	27	27	29	31	33
2009 ACTUALS	1	4	8	12	13	18	25	28	31	31	33	34
2010 ACTUALS	1	3	5	6	7	10	11	11	12	14	16	16
2011ACTUALS	2	5	8	9	12	14	16	18	23	26	28	28
2012 ACTUALS	2	4	7	7	11	14	17	19	21	23	27	27
2013 ACTUALS	3	4	5	6	6	9	10	10				

Only 1 laser incident in this period – 2009

- 2013 Total All Newport Sites – 10 YTD
- 2012 Company Goal – minimum 10% reduction vs. '12
- <u>Maintain daily focus on "0" injuries !!</u>

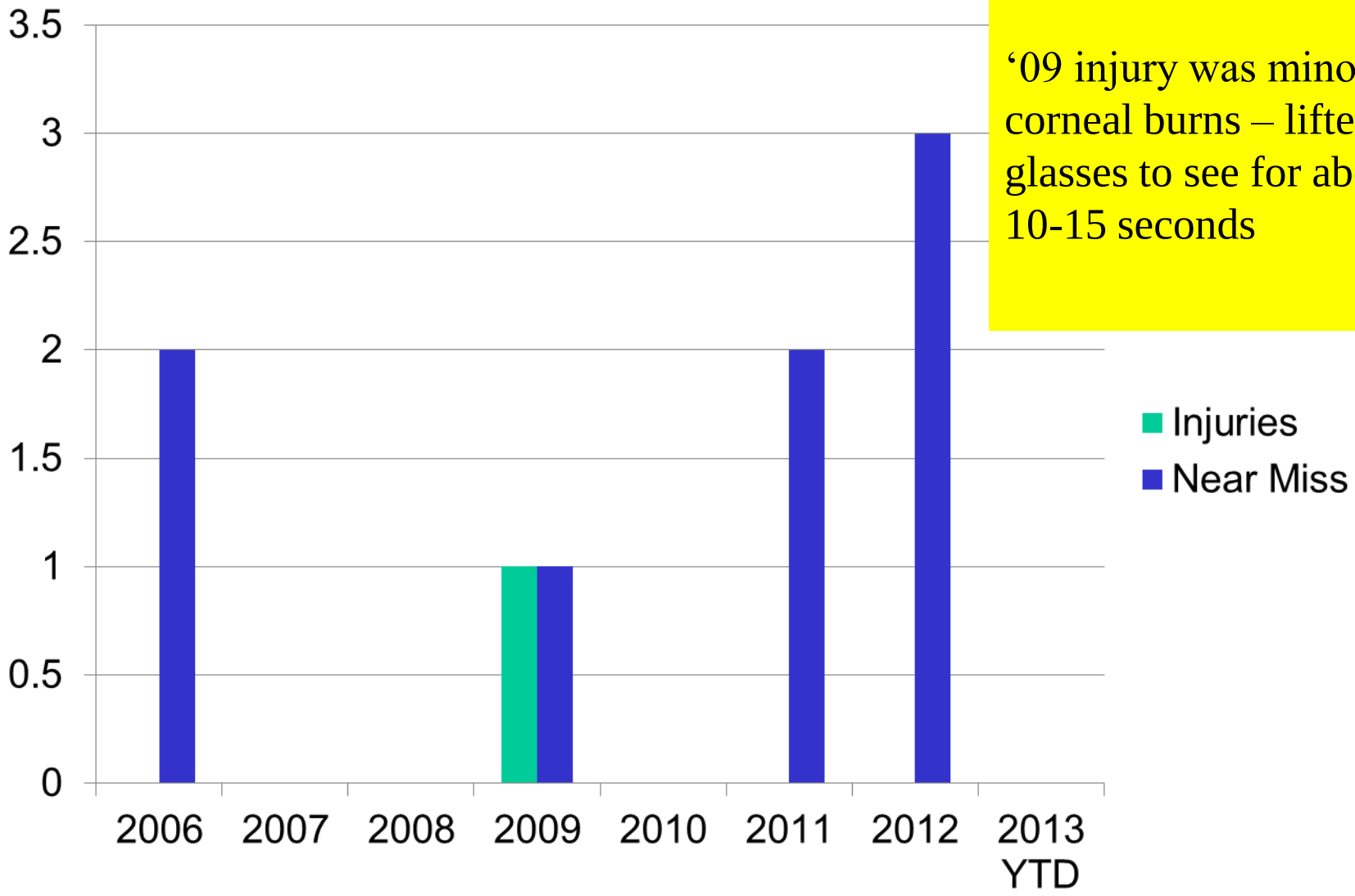
'06-'13 Lost Time Days from Injury – All Newport as of 8/1/13



	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
2006 ACTUALS	8	32	83	131	170	200	267	276	301	343	365	386
2007 ACTUALS	51	80	117	137	163	188	228	259	279	279	284	298
2008 ACTUALS	0	0	15	35	51	72	85	85	91	91	91	91
2009 ACTUALS	0	10	11	11	11	11	37	50	70	96	145	185
2010 ACTUALS	1	1	1	1	1	1	1	1	1	1	1	1
2011 ACTUALS	0	0	0	0	15	59	78	78	78	103	127	149
2012 ACTUALS	0	0	0	0	0	7	28	28	28	68	94	94
2013 ACTUALS	20	32	32	32	32	32	32	32	0	0	0	0

Daily focus on "Zero" Lost Time days & Injuries
- **Minimum 10% reduction goal in 2013**
- **2013 YTD Total – 32**

Laser Safety Performance – '06-'13 YTD



'09 injury was minor corneal burns – lifted glasses to see for about 10-15 seconds

Overview of Newport/SP Laser Safety Management

Laser Safety Officer

Deputy Laser Safety Officer or Contacts

- Site & Business Group Management Support is the foundation at all sites
- Director EHS role supports overall safety management at Newport
- Laser Safety Officer
  - Full or Part Time role; Supports overall laser safety management to business group and/or site
  - Can include Occupational & Product Safety tasks
  - Training and/or certification on ANSI Z136.1 Standard requirements
- Deputy Laser Safety Officer
  - Support role to LSO or serve as the main contact/s for laser safety (varies by site and assessed risks)
  - Part time role along with other duties
  - Coordinates and/or conducts routine internal audits; Manages laser eyewear, signage & training
  - Trained to appropriate areas of ANSI Z136.1 Standard requirements
- Field Service Staff for Laser Products
- Other support at each site from Facilities & Human Resources
  - Medical surveillance plans through HR – baseline eye exams
  - Engineering lab improvements with Facilities
- Driving the laser & general safety message to all levels of organization

Laser Safety Training at Newport - Examples

- Newport employees receive various types of laser safety training
- Extent of training depends on job description, task requirements, risk exposure and applicable regulatory requirements
- Training delivered via web based, classroom & “OJT” methods
- Examples of how laser safety is covered are as follows:
  - All Newport Employees
    - Annual “Safety Awareness Review” – refresher on key safety items for all employees (i.e. Emergency response, chemical safety, ergonomics), includes basic laser safety review
  - Operations Employees (examples of training for those working directly or indirectly with lasers)
    - “Laser Safety Basics Review for Non Users” – Newport developed web based course
    - “Laser Safety Basics” – web based course through external recourse
    - Laser Safety courses at site specific level – classroom sessions at Santa Clara, Irvine or other locations
    - “OJT” laser training using “method sheets” or other process documentation
    - Customer specific EHS requirements
  - Field Service Staff for SP Lasers, Newport MRSI and other product lines or business groups

Compliance, Best Practices & Challenges

At Spectra Physics, we build each laser model with "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 step

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.

15 lbf.in

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.

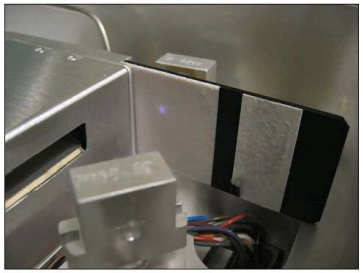
Confidential – SP SSL Proprietary

MS#: 90037496	Page: 51 of 207	Revision: E
Product: ICSHG-15-23, FRU ICSHG-15-23		
Operation #:700	Process Time	
Process ID: VERIFY CONCENTRIC BEAM THRU YLF ROD		
WORK CONTENT	VERIFY	TQC

Bill of Materials

Find	Part #	Qty	Description

1. Verify alignment beam is concentric through YLF rod. Repeat previous 8 pages if necessary.



Confidential – SP SSL Proprietary

Laser Lab SOP – Other Example

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 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

- This is a basic laser safety SOP example used at Newport sites
- Other SOPs can be very specific to product & operational processes as in the Method Sheets at Santa Clara

Field Service Staff Training – Spectra Physics

- SP Field Service Staff are trained annually on a variety of EHS requirements

- Goal is to prevent injuries of our employees and customers along with meeting applicable regulatory compliance requirements

- Topics include
  - ANSI Z136.1 Laser Safety Review
  - Control of Hazardous Energy (Lockout/Tagout)
  - Compressed Gases (General Requirements)
  - DOE Worker Safety & Health Program
  - Power Supply & Laser Head Electrical Safety
  - Safety Related Work Practices (i.e. PPE, Machine Guarding)
  - Awareness Level Safety Overview (i.e. Noise, Emergency Response, Haz Com, Respiratory Protection)

SP Lasers Field Service Team – EHS Annual Training

This is an example of the letter the service department would send to a DOE lab documenting the level of safety training a Spectra Physics service engineer takes on a yearly basis

Spectra-Physics

June 14, 2013

Mr. xxxxx xxxxx
Lawrence Berkeley National Laboratory
1 Cyclotron Road, MS 75R0123
Berkeley, CA 94720

Dear **Mr. XXXX XXXX**

This letter is sent to confirm the Environmental, Safety and Health training for **Mr. Dennis Merritt**, 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

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) 9980-3741
Cell: (510) 821-2325
Email: kerry.diaz@newport.com

SP Field Service – Example Customer Communication on Safety Policies

Spectra-Physics

Spectra-Physics
3635 Peterson Way
Santa Clara, CA 95054
Tel 408-980-4300

www.newport.com/spectra-physics

Date: January 30, 2013

NASA Goddard Space Flight Center
Mail Code 554
Greenbelt, MD 20771

Attention: Rogenia M. B. Dean (GSFC – Code 210)

Spectra-Physics has submitted to you Newport's Corporate Policy on Safety, along with other pertinent information required to satisfy NASA General Safety Requirements. This Policy clearly defines how Newport's employees shall behave in emergencies and other safety related situations. Whenever Spectra-Physics sends an employee to NASA that employee shall use the Corporate Policy Standards as a behavioral guide to any emergency he or she may encounter while at the NASA site. The employee shall make contact with the NASA Safety Officer before commencing work. The Safety Officer will make clear to the employee what the NASA Safety Procedures and Guidelines are and the employee shall agree to follow the recommendations and requirements of the NASA Safety Officer.

As pertains to:
Work Order 4087399
PIV-400-30 serial # 1132P
REFERENCE PURCHASE ORDER # NNG12HA49P
RA# 7059513

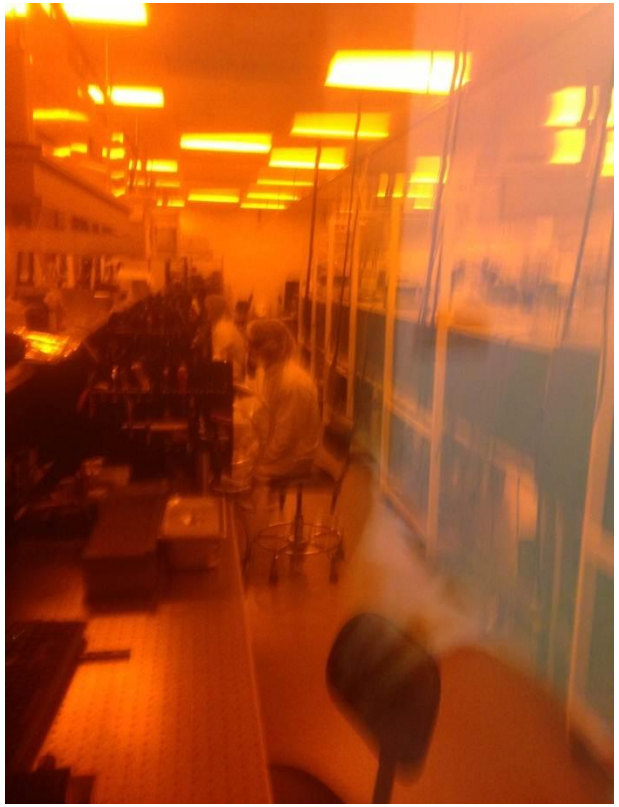
The employee who is sent NASA to complete the requirements of the above referenced Work Order shall be trained to work on lasers and to carry out the requirements of this Work Order.

William Maloney

Senior Facilities, EHS Manager

Once a FSE completes his annual training he receives a card to carry and show he is in compliance with the required training.
All Spectra Physics service engineers carry Safety glasses for each laser type he may work on.

Laser Lab & Work Area Requirements



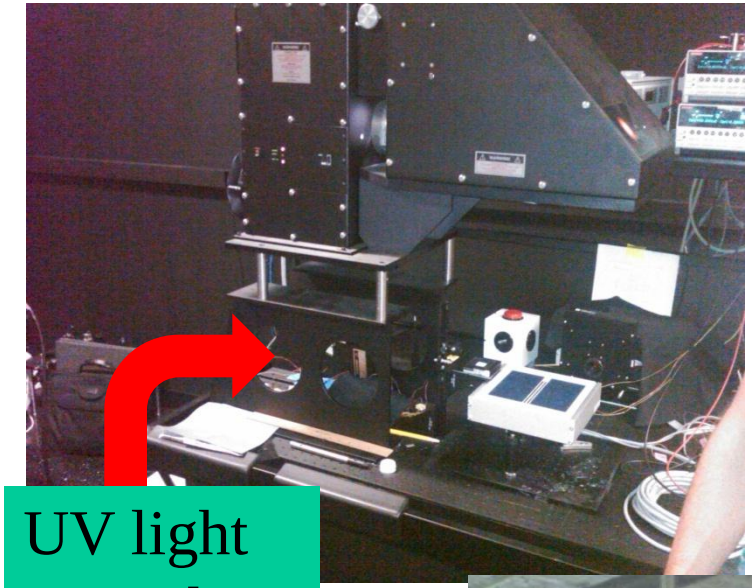
- Typical requirements found in Newport laser labs & work areas
  - Clean rooms – eliminating or minimizing dust helps reduce beam scatter risks, and damage to laser optics
  - Viewing windows into large work areas for monitoring worker safety
  - Engineering controls such as interlocks, EPOs, remote view cameras, beam blocks, barriers, curtains, etc.
  - Documented SOP's supporting engineering controls in place
  - PPE such as laser glasses, gowns, smocks, gloves, etc.
  - Restricted locations 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 Safety Auditing – Example Form Used

Zone _____ Inspection Performed by _____ Date _____

	Y	N	NA	COMMENTS
A. Administrative				
1. Lasers are classified appropriately (2, 3a, 3b, 4a, 4b)				
2. Standard operating procedures are available				
3. Alignment procedures are available				
4. Viewing cards are used for alignment				
5. Laser users attended appropriate training				
6. Lasers are included in inventory				
B. Labeling and Posting				
1. Certification label present				
2. Class designation and appropriate warning label present				
3. Radiation output information on label				
4. Aperture label present				
5. Appropriate warning/danger sign at entrance to laser area				
6. Warning posted for invisible radiation				
C. Control Measures				
1. Protective housing present and in good condition				
2. Beam attenuator present				
3. Laser table below eye level				
4. Beam is enclosed as much as possible				

Engineering Controls at Labs - Examples

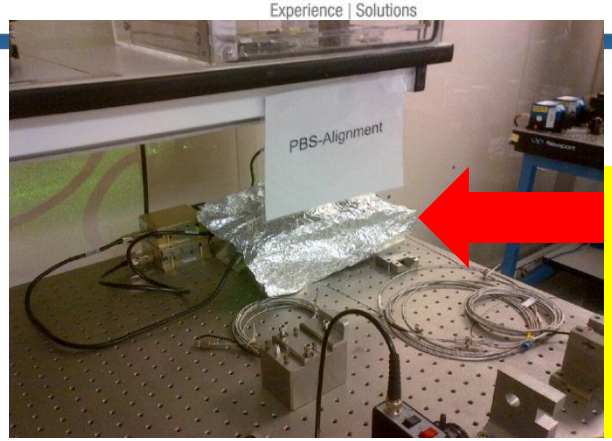


UV light control shields

Key or pad code locks on lab doors

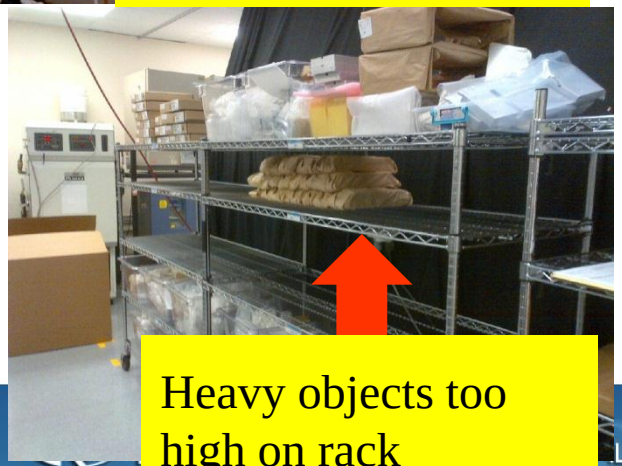
Portable laser room walls

Challenges to Laser Safety



Foil as guard

Wall as firing target



Heavy objects too high on rack

- Nothing is perfect, we all face a variety of laser safety challenges
- Overall laser safety managed well, but hazards are identified from audits or “spot checks”
- Created mostly from unintentional oversight – not deliberate intent to create hazards
- These can include a variety of items:
  - Lack of PPE or wrong type
  - Use of the wall as a “firing target”
  - Aluminum foil as a “laser guard”
  - Electrical hazards
  - General housekeeping issues
  - Lifting hazards
  - New hires missing training
- Solutions on a broad or case by case basis

“Real Life” Incidents & Lessons Learned

Laser Near Miss Report Review – Santa Clara

"Near Miss" Laser Incident Report

Person Reporting Incidence: Taryn

Date & Time of Occurrence: Friday, November 30, 2012 around 1 P.M

Where Incident Occurred: Mai Tai/Ultrafast Marketing Lab

Primary Lab Operator: Pat

Primary Lab Supervisor: Julien

Was Laser Lab Warning Light ON?: Yes

Incident Report (What Happened): Intern Taryn entered the Mai Tai/Ultrafast Marketing Lab, (Note the Door was NOT Locked), and immediately experienced exposure to Green Laser Radiation at the entry door. It appeared to her that this exposure was to not scattered Laser Radiation but direct exposure to the Laser's Output Beam. Taryn said she was wearing Laser protective eye wear at the Time, with an Optical Density of 7 between 190 to 534nm. The Laser System in question was a Millennia to Tsunami to Radiantis Inspire (Millennia and Tsunami beam tubed with covers in Place), Inspire with cover off was in the process of internal alignment. According to Taryn the exposure came from this system that was on the Laser Table at the Back of the Lab. Pat told us that the Inspire could have produced green light at 550 nm inter-cavity, which the Laser Safety Glasses that Taryn was wearing would NOT have blocked. Her glasses roll off their attenuation sharply at 534 nm. If what she saw was 550 nm, she would have seen it through the Laser Safety Glasses she said she was wearing. Pat indicated that the Inspire Laser in the configuration it was in on Friday, had zero possibility of producing an Output Beam, as no Output coupler had yet been installed. It was determined that the cause of the "Scatter" was off the S2 surface of a frequency doubling non-linear optical crystal.

I Had Pat reconfigure the Laser to the condition it was in on Friday, producing 550 nm Green inter-cavity, turn it on, and then turned the lights in the Lab off. There was definitely Green "Scatter" visible on the inside of the Door from about 4 feet to about 8 feet high, which was visible through the Laser Safety Glasses that Taryn would have been wearing, and through her glasses what I saw did look like a collimated beam! And, NO, I didn't look at the scatter, I wore Glasses that attenuated 550 nm, and took a photograph with the Glasses she was wearing in front of the camera lens.

Incident Documented By: David Marshall LSO, Bill Frevert DLSO

How did the beam get out of the cavity?

Corrective Action Recommended: Short term, add a sheetmetal beam block 2 feet wide by 15 Inches Tall to the end of the Laser Table, and update the Laser Warning Sign to add the 550 nm wavelength

Long Term: I purchased a free standing Kentek Ever-Guard Modular 2 Panel Laser Barrier Model PG-EVG6, and placed it in an "L" configuration inside the Entry Door, for use when the Inspire frequency converter was being worked on.

Laser Near Miss Report Review – Santa Clara

We reviewed the signage and confirmed the possible radiation sources. We make sure the minimum O.D. is clear to anyone who plans to enter.

By placing a solid barrier inside the Marketing Lab entrance, the chance of an unintentional exposure is mitigated.

Laser Lab Safety Issues & "Near Miss" - Irvine

Lab area - issues found during incident follow up

Lab area – after corrective action changes

- Laser & OEM Engineering Lab
- Employee went into unlocked lab while laser firing during test, almost took direct hit from class 4 IR laser
- Incident reported & follow up identified various issues & solutions
- Corrective Action Improvements:
  - Refresher laser training for all staff
  - Housekeeping procedures & controls
  - Internal audit schedule
  - Key pad locks on all doors

Typical "Lessons Learned" & Example Improvements from all sites

- Employee training – laser, chemical safety, emergency response, electrical safety, etc.
- Documentation – SOP's, written programs, policies, etc.
- Engineering Controls – interlock systems, security/card access, laser barriers, beam blocks, air filtration systems, etc.
- PPE Requirements – laser safety eyewear, gloves, clothing, footwear, etc.
- Other – housekeeping, internal auditing, resources (people, budget & time)

All "Accidents" are Preventable . . . .

- However…Only if you have these:
  - **Proper planning**
  - **Proper training**
  - **Proper assignments**
  - **Proper scheduling**
  - **Proper equipment**
  - **Proper attitudes**
  - **Proper behaviors**
  - **Proper documentation**

Safety Is Everyone's Responsibility!!

Where Can Management Impact Laser & General Safety?

- Safety as topic on regular staff meeting agenda
- Emphasize the importance of reporting all hazards & near miss incidents
- Assure follow up on hazards & near misses happens
- Communicate with site EHS contact on projects that have safety risks
- Complete required inspections on manufacturing equipment & process areas
- Employee Safety performance tracked in employee review process
- Investment in safety does pay …
  - Cannot place a price on the health & safety of employees
  - Recent studies have shown that for each $1 investment = $6 ROI avg.
  - Reduction in injuries = production, quality & morale increases
- **All of this helps support building a strong safety culture!!**

External Support Resource Examples – Laser & General Safety

- **Insurance Loss Control consultation**
  - **Most Workers Comp carriers provide services for safety program support**
  - **Leverage these services - you are already paying for them!**

- **Training and education information**
  - **Internet locations providing**
    - **Free Safety Power Point Slides!!**
    - **Regulatory compliance information**
    - **Awareness and motivation materials**

- **Network with professional organizations & resources**
  - **ASSE**
  - **National Safety Council**
  - **All of those suppliers & services at DOE LSO Workshop '13!!**

- **Government resources**
  - **OSHA Consultation at Federal & State level**
  - **US Dept. of Energy**

Summary/Wrap Up & Discussion

- Food for thought from today:
  - Newport & Spectra Physics has an overall very good safety performance record through it's history
  - However, that does not happen without support, involvement & dedication of employees
  - Challenges are there and we have made a few errors – learn from them! All about continuous improvement in safety and in life
- Other questions, comments?
- Thanks for your attention and participation!!