

Occurrence Report

After 2003 Redesign

National Renewable Energy Laboratory

(Name of Facility)

Solar Activities

(Facility Function)

National Renewable Energy Laboratory

National Renewable Energy Laboratory

(Site)

(Contractor)

Name: Rukavina, Frank**Title:** EHS Office Director**Telephone No.:** (303) 275-3220

(Facility Manager/Designee)

Name: OKANE, BARBARA V.**Title:** ENVIRONMENTAL H & S SENIOR ES&H SPEC**Telephone No.:** (303) 384-7609

(Originator/Transmitter)

Name:**Date:**

(Authorized Classifier (AC))

1. Occurrence Report Number: EE-GO--NREL-NREL-2008-0012

Maintenance Technicians Enter a Laser Laboratory and Trip Door Safety Interlocks

2. Report Type and Date: FINAL

	Date	Time
Notification:	11/10/2008	19:14 (ETZ)
Initial Update:	12/19/2008	19:17 (ETZ)
Latest Update:	12/19/2008	19:17 (ETZ)
Final:	12/19/2008	19:17 (ETZ)
Revision 1:	01/30/2009	16:22 (ETZ)

3. Significance Category: 3**4. Division or Project:** Energy Sciences/**5. Secretarial Office:** EE - Energy Efficiency and Renewable Energy

6. System, Bldg., or Equipment: SERF

7. UCNI?: No

8. Plant Area: SERF E134

9. Date and Time Discovered: 11/07/2008 10:00 (MTZ)

10. Date and Time Categorized: 11/10/2008 08:30 (MTZ)

11. DOE HQ OC Notification:

Date	Time	Person Notified	Organization
NA	NA	NA	NA

12. Other Notifications:

Date	Time	Person Notified	Organization
11/10/2008	09:00 (MTZ)	Karen Harness	DOE GO

13. Subject or Title of Occurrence:

Maintenance Technicians Enter a Laser Laboratory and Trip Door Safety Interlocks

14. Reporting Criteria:

10(3) - A near miss, where no barrier or only one barrier prevented an event from having a reportable consequence. One of the four significance categories should be assigned to the near miss, based on an evaluation of the potential risks and the corrective actions taken. (1 of 4 criteria - This is a SC 3 occurrence)

15. Description of Occurrence:

A laser operator who was running laser experiments stepped out of the laboratory for a few minutes. (Note: leaving laser operations unattended is acceptable because there are adequate safety controls in place including safety interlocks on both doors). Upon returning to the laboratory he found that the laser safety interlocks had been tripped. He initially thought that a co-worker had tripped the interlocks. He later learned that some maintenance technicians had entered the lab to assess a work request.

Update 12/19/2008

Two Site Operations maintenance technicians, who were tasked to install a cable tray, entered Solar Energy Research Facility (SERF) laser laboratory E134 twice (the second time they only got as far as the door threshold) on November 6, 2008 while the "LASER IN USE" sign was illuminated and laser was active.

Entry 1

At approximately 6:10 pm, the technicians entered the lab through the south door. They were wearing regular safety glasses, not laser protective eyewear. The door safety interlock was tripped causing the laser shutter to close. The lab was not occupied at the time. The technicians scoped out their job and left the lab to retrieve the necessary materials needed to complete the work.

Entry 2

When the technicians returned to the lab, they opened the south door. This time, the door interlock did not activate because the laser operator had just entered the laboratory through the north door and had invoked a 30 second time delay on the door interlock (this permits the operator to leave and re-enter the room without interrupting the experiment). Because the technicians opened the door at the same time the door interlocks were bypassed, the laser shutters did not close and laser energy was being emitted on the optical table. The technicians were not wearing the proper laser safety glasses. The laser operator stopped the technicians from entering into the lab and immediately asked the technicians to leave the lab.

The technicians were not exposed to hazardous laser energy during either entry into the lab.

Background information - Entry 1

On October 10, 2008, during a routine safety inspection low hanging cords were identified as a hazard in SERF E134. A work order was composed to install an overhead cable tray to eliminate the hazard.

The Building Area Engineer (BAE) received the work order and walked down this job with the lead technician around October 10, 2008. Since the lead technician had difficulty scheduling the job during the day due to laser activities, the work order was handed to the B-shift technicians who usually work from 3 PM to 11 PM. A B-shift technician scoped the job with the lead technician and the laser operator on October 31, 2008. On the evening of Wednesday, November 5, 2008, a B-shift technician saw the "Laser In Use" sign was illuminated. The B-shift technician knocked on the door and did not receive a response, so the technician decided not to enter.

The next evening Thursday, November 6, 2008, at approximately 6:00 PM the NREL qualified laser operator started a new laser experiment that was expected to last 15 to 20 minutes. The laser had been in use all day, so the door interlocks were already activated and the "LASER IN USE" signs were illuminated above both doors. The laser operator exited the north door by depressing the door interlock bypass button, which allows 30 seconds to open the E134 doors without closing the laser shutter.

Around 6:10 PM, the same B-shift technicians as the day before approached E134 through the service corridor. They noted the "LASER IN USE" sign was illuminated. They knocked on the door and did not receive a response. They did not make further attempts to contact lab users (e.g. try to reach them by phone). The technicians believed the researchers must have inadvertently left the warning light illuminated and that, in fact, the laser was not in actual operation. The technicians stated they believed this was the case because:

1. The "LASER IN USE" sign seemed to have been illuminated for weeks;
2. During the walk down on October 31, 2008, the laser operator informed the technicians that that there would be opportunities to perform the work in the next couple of weeks;
3. They knew the warning sign could be activated by a manual switch;
4. Like hazardous production materials (HPM) operations, they thought that laser operations could not be left unattended; and
5. They thought that potentially hazardous experiments were not typically conducted after normal business hours.

The laser operator reported that although the warning sign had been illuminated a few times when the laser was not operating, it had not been continuously/incorrectly illuminated for weeks at a time.

Because the doors to the laboratory are locked, the two technicians went into the basement of the SERF to the master key box and retrieved the key to E134. The technicians returned to the lab and entered the south door using the key. When they opened the door, unbeknownst to them, the interlock closed the laser shutters. Nothing out of the ordinary was observed by the technicians and so they entered the lab. The technicians were wearing their safety glasses with side shields, but not laser safety glasses. The technicians scoped the job and then left the lab to gather supplies for the task.

After the technicians left the lab, the laser operator returned to E134. The laser operator noticed the experiment had stopped, suggesting a door had been opened without by-passing the interlock. The laser operator thought that a graduate student had inadvertently (forgot to use the bypass switch) tripped the interlock. The laser operator restarted the laser,

which activated the door interlocks. The "Laser In Use" signs remained illuminated throughout this time (it does not extinguish when a door interlock is tripped). The laser operator exited the north door, by-passing the door interlock and went to look for the graduate student.

Entry 2

When the laser operator failed to locate the graduate student the operator returned to E134 a few minutes later. The laser operator entered through the north door, by-passing the door interlock: (note: the "LASER IN USE" signs remain illuminated during this bypass period.) Within this 30 second interlock delay, the technicians started to open the south door and attempted to enter the lab. The laser shutter did not close because of the interlock by-pass. The laser operator stopped their entry and immediately asked them to come back in 15 minutes. The laser operator then shut down the laser.

The laser operator, Laser System Supervisor and the Laser Safety Officer agreed that they believed that there was no risk of laser injury to the B-shift technicians because the laser energy was confined to the optics bench.

Informational Note: E134 doors require a key to open. Authorized E134 laser operators, Site Security and Site Operations have access to keys to open the doors. When entering the lab, the door interlocks can only be bypassed by keying in the correct password on the keypad. This is a Class 4 laser laboratory running in an "open beam" configuration. Stray laser energy is controlled through proper alignment and the use of one foot tall black anodized aluminum panels placed around the perimeter of the optical table. Activities of this experiment are covered in the approved Safe Operating Procedure SOP 502009408 Laser Spectroscopy Lab. Both laser lab doors have ANSI laser signs posted.

16. Is Subcontractor Involved? No

17. Operating Conditions of Facility at Time of Occurrence:

Normal

18. Activity Category:

03 - Normal Operations (other than Activities specifically listed in this Category)

19. Immediate Actions Taken and Results:

The laser operator immediately asked the B-shift technicians to exit the lab, then shut down the laser.

Friday morning November 7, 2008, the laser operator reported what happened to the Laboratory Operations Official (LOO). The LOO informed the Environment, Health, & Safety Point of Contact (EHS POC), at 10:00 AM. The EHS POC reported the incident by e-mail to the Laser Safety Officer (LSO) on Saturday, November 8, 2008.

On Monday November 10, 2008:

20. ISM:

- 2) Analyze the Hazards
- 4) Perform Work Within Controls

21. Cause Code(s):

A1B2C08 - Design/Engineering Problem; Design output LTA; Errors not detectable

A3B2C05 - Human Performance Less Than Adequate (LTA); Rule Based Error; Situation incorrectly identified or represented results in wrong rule used

-->couplet - NA

22. Description of Cause:

A. Entries 1 and 2: The technicians observed the illuminated warning sign, but ignored it.

B. Entries 1 and 2: Wrong actions were selected based on similarity with other actions. The technicians believed that the rules they understood existed in the HPM labs applied to all the labs.

C. Entries 1 and 2: Bases for the technician's assumption that the "Laser In Use" sign was incorrectly illuminated:

1. The "LASER IN USE" sign seemed to have been illuminated for weeks;
2. During the walk down on October 31, 2008, the laser operator informed the technicians that that there would be opportunities to perform the work in the next couple of weeks;
3. They knew the warning sign could be activated by a manual switch;
4. Like HPM operations, they thought that laser operations could not be left unattended; and
5. They thought that potentially hazardous experiments were not typically conducted after normal business hours.

D. Entry 2: When either door interlock is bypassed, it bypasses both door interlocks simultaneously.

E. Entries 1 and 2: Planning between workgroups was less than adequate. The lab user and the technicians did not coordinate on a time for performance of the work. Site Ops had walked down the job prior to performing the work, as is the normal practice when conducting work in a laboratory, but the job was not specifically scheduled.

F. Entries 1 and 2: F. Inaccurate risk perception due to the assumption that the "Laser In Use sign" was incorrect. The technicians combined their observations and knowledge to conclude that there were no laser operations and there was no hazard beyond the normal skill of the craft.

G. Entry 2. Previous "success" in entry reinforced second lab entry.

23. Evaluation (by Facility Manager/Designee):

There were no injuries or interruptions to Laboratory operations.

There was no exposure to laser energy.

Laser safety interlocks functioned as designed and shuttered laser energy when the door interlock was tripped.

24. Is Further Evaluation Required?: No

25. Corrective Actions

(* = Date added/revised since final report was approved.)

1. Engage the technicians in a discussion to understand what would have helped them in this situation. Determine if further corrective actions are appropriate.

Target Completion Date: 01/31/2009

Completion Date: 01/22/2009

2. Derive periodic refresher training on hazard identification and control, that includes a discussion of administrative controls such as signage.

	Target Completion Date: 04/01/2009	Completion Date:
3.	Establish a work group to resolve issues with and institute a coordinated mechanism for scheduling and communicating site operations work orders.	
	Target Completion Date: 02/27/2009	Completion Date:
4.	Share lessons learned from this event with Site Operations personnel and reinforce the use of the established practice to coordinate with lab personnel prior to performing work in a laboratory.	
	Target Completion Date: 01/31/2009	Completion Date:
5.	Share lessons learned with Security staff.	
	Target Completion Date: 12/31/2008	Completion Date:
6.	Evaluate feasibility of independently wiring laser safety door interlocks.	
	Target Completion Date: 02/15/2009	Completion Date:
7.	Share lessons learned from this event with Laser Safety Panel, Laser System Supervisors and with DOE Laser Safety Group.	
	Target Completion Date: 02/15/2009	Completion Date:
8.	Evaluate feasibility of independently wiring laser safety door interlocks.	
	Target Completion Date: 02/15/2009	Completion Date: 01/22/2009
9.	Evaluate feasibility of independently wiring laser safety door interlocks.	
	Target Completion Date: 02/15/2009	Completion Date: 01/22/2009

26. Lessons Learned:

1. Inaccurate assumptions can lead to inaccurate hazard recognition and control.
2. The current configuration of the laser safety door interlocks cannot be 100% protective. It is possible, although very unlikely, for someone to enter a laser lab without tripping a safety interlock. An authorized laser operator can by-pass the door interlock, exit the lab and someone else can enter through a second door during that by pass interval without tripping the interlock and perhaps be in an active laser lab unprotected.

27. Similar Occurrence Report Numbers:

None

28. User-defined Field #1:

29. User-defined Field #2:

30. HQ Keyword(s):

- 01A--Inadequate Conduct of Operations - Inadequate Conduct of Operations (miscellaneous)
- 01F--Inadequate Conduct of Operations - Training Deficiency
- 01N--Inadequate Conduct of Operations - Inadequate Job Planning (Other)
- 01O--Inadequate Conduct of Operations - Inadequate Maintenance

01P--Inadequate Conduct of Operations - Inadequate Oral Communication
01Q--Inadequate Conduct of Operations - Personnel error
08C--OSHA Reportable/Industrial Hygiene - Industrial Hygiene Exposure
08H--OSHA Reportable/Industrial Hygiene - Safety Noncompliance
08K--OSHA Reportable/Industrial Hygiene - Near Miss (Other)
12B--EH Categories - Conduct of Operations
14B--Quality Assurance - Training and Qualification Deficiency
14E--Quality Assurance - Work Process Deficiency

31. HQ Summary:

On November 7, 2008, a laser operator who was performing laser experiments, stepped out of the laboratory for a few minutes. Upon returning to the laboratory he found that the laser safety interlocks had been tripped. He later learned that maintenance technicians had entered the lab to assess a work request. The laser safety interlocks functioned as designed and shuttered laser energy when the door interlock was tripped.

32. DOE Facility Representative Input:

33. DOE Program Manager Input:

34. Approvals:

Approved by: Rukavina, Frank, Facility Manager/Designee

Date: 12/19/2008

Telephone No.: (303) 275-3220

