

# Occurrence Report

## After 2003 Redesign

Lawrence Livermore Nat. Lab. (BOP)

(Name of Facility)

Laboratory - Analytical

(Facility Function)

Lawrence Livermore National Lab.

Lawrence Livermore National Lab.

(Site)

(Contractor)

**Name:** Thomas Diaz de la Rubia

**Title:** Principal Deputy Associate Director, PLS

**Telephone No.:** (925) 422-6714

(Facility Manager/Designee)

**Name:** FREEMAN, JEFFREY W

**Title:** OCCURRENCE REPORTING

**Telephone No.:** (925) 424-6787

(Originator/Transmitter)

**Name:**

**Date:**

(Authorized Classifier (AC))

**1. Occurrence Report Number:** NA--LSO-LLNL-LLNL-2008-0067

Building 174 Laser Operations Procedural Weakness

**2. Report Type and Date:** FINAL

	<b>Date</b>	<b>Time</b>
<b>Notification:</b>	12/23/2008	18:15 (ETZ)
<b>Initial Update:</b>	01/05/2009	16:18 (ETZ)
<b>Latest Update:</b>	01/29/2009	19:48 (ETZ)
<b>Final:</b>	01/29/2009	19:48 (ETZ)

**3. Significance Category:** 3

**4. Division or Project:** S&T

**5. Secretarial Office:** NA - National Nuclear Security Administration

**6. System, Bldg., or Equipment:** B174 Callisto Laser

**7. UCNI?:** No

**8. Plant Area:** Site 200

**9. Date and Time Discovered:** 12/19/2008 09:30 (PTZ)

**10. Date and Time Categorized:** 12/19/2008 10:15 (PTZ)

**11. DOE HQ OC Notification:**

Date	Time	Person Notified	Organization
NA	NA	NA	NA

**12. Other Notifications:**

Date	Time	Person Notified	Organization
12/19/2008	11:00 (PTZ)	Dave Aron	NNSA/LSO
12/19/2008	11:20 (PTZ)	Tracey Simpson	ESH TL
01/05/2009	13:05 (PTZ)	John Retelle	NNSA/LSO
12/19/2008	11:10 (PTZ)	Rex Beach	LEDO

**13. Subject or Title of Occurrence:**

Building 174 Laser Operations Procedural Weakness

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**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)

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**15. Description of Occurrence:**

On December 18, 2008, two employees (a researcher and a technician) were working in the Callisto Laser Laboratory within Building 174 when the laser was prematurely fired. Upon hearing the audible laser firing message, which precedes the firing of the laser, the workers in the laboratory immediately opened the interlocked door to the hallway which is intended to terminate the laser firing sequence before the laser fires. The door was opened too late to prevent the laser from firing and it is believed that some laser light was allowed to enter the room. However, the presence of a designed obstruction in the beam path (which has to be removed

prior to operations) resulted in a blockage of the majority of the laser power to the target chamber where the employees were located.

The control room operator believed he received the "all clear" message from the employees in the Callisto Laser Lab, but confusion with communications may have led to the inadvertent firing of the laser. The initial communication process which occurs by radio between researchers and the control room operators was halted in this particular experiment and the extra communication that was needed to resume the sequence may have been unclear.

The employees did not believe they were exposed to any hazardous levels of energy and did not seek medical attention. Due to the presence of the diode and the use of laser eyewear, no eye damage is expected. The nature of this particular shot also makes it highly unlikely that the employees were exposed to other potentially harmful radiation (i.e., x-rays). The actual event occurred at approximately 11:15 AM, but since it did not appear to be a serious incident in terms of potential exposure or injury, reporting up the management chain was delayed until later that afternoon. The issue of the inadequacy of the communication procedure, specifically the reliance on two-way radios being operated by multiple users (both within the specific experiment and within Building 174 itself) was identified as a Management Concern by the Physical and Life Sciences Directorate management at approximately 10:15 AM on December 19, 2008.

On December 30, 2008, PLS management determined that the diode was not an engineered feature that was designed for worker protection. In fact, it is designed to be removed immediately prior to a laser shot. Therefore, only one barrier (the laser safety eyewear) can be considered to have been in place to prevent a potentially more severe occurrence and this event has been reclassified as a Near Miss.

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**16. Is Subcontractor Involved? No**

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**17. Operating Conditions of Facility at Time of Occurrence:**

Does not apply

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**18. Activity Category:**

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

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**19. Immediate Actions Taken and Results:**

Upon crashing the interlock (i.e., opening the door from the laser lab to the hallway), the affected employees met with the control room operator and the Building 174 Operations Manager. The experimental process and laser configuration were examined to determine if any potential significant exposure (both laser and x-ray) could have occurred. Additional operations with the laser were continued after developing additional administrative controls (additional iterations of

the all clear confirmation). Directorate management made the determination that no high powered laser operations or laser operations requiring Control Room involvement could commence until likely causes were identified and corrective actions implemented.

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## 20. ISM:

- 2) Analyze the Hazards
- 3) Develop and Implement Hazard Controls
- 4) Perform Work Within Controls
- 5) Provide Feedback and Continuous Improvement

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## 21. Cause Code(s):

A3B1C02 - Human Performance Less Than Adequate (LTA); Skill Based Errors; Step was omitted due to distraction

-->couplet - A4B3C07 - Management Problem; Work Organization & Planning LTA; Job scoping did not identify potential task interruptions and/or environmental stress

A3B1C07 - Human Performance Less Than Adequate (LTA); Skill Based Errors; Omission/repeating of steps based on assumptions for completion

-->couplet - A4B1C01 - Management Problem; Management Methods Less Than Adequate (LTA); Management policy guidance / expectations not well-defined, understood or enforced

A4B1C04 - Management Problem; Management Methods Less Than Adequate (LTA); Management follow-up or monitoring of activities did not identify problems

A4B1C07 - Management Problem; Management Methods Less Than Adequate (LTA); Responsibility of personnel not well defined or personnel not held accountable

A4B1C08 - Management Problem; Management Methods Less Than Adequate (LTA); Corrective action responses to a known or repetitive problem was untimely

A4B2C06 - Management Problem; Resource Management LTA; Means not provided to assure procedures / documents / records were of adequate quality and up-to-date

A5B4C04 - Communications Less Than Adequate (LTA); Verbal Communications LTA; Verification / repeat back not used

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## 22. Description of Cause:

While no formal Root Cause analysis was required for this incident based on its categorization, PLS management commissioned a management review which determined that a lack of formality in facility operations was the root cause.

The following is a listing of the apparent causes as identified through the "Change Analysis" process (a form of elicitation).

A3B1C02 - Step was omitted due to distraction. Due to distractions, both in the control room and the target bay, the communication step in the procedure for verifying that the room was all clear was omitted (or erroneously assumed to be completed). Couplet A4B3C07 - Job scoping did not identify potential task interruptions and/or environmental stress. Corrective Actions #3 and #4 will minimize the reliance on the two-way radios and would eliminate several unnecessary communication steps between target bay personnel and the Control Room Operator by implementing a "key permissive" engineered control and a more formal sweep process.

A3B1C07 - Omission/repeating of steps due to assumption for completion. The Control Room Operator assumed that the communication steps in the procedure, including the all clear, were completed. Couplet A4B1C01 - Management policy guidance/expectations not well-defined understood or enforced. Corrective Action #3 and #4 will include implementing a "key permissive" engineered control and associated sweep process that will minimize the reliance upon verbal communication.

A4B1C04 - Management follow-up or monitoring of activities did not identify problems. Concerns with the effectiveness of the radios and the errors with the building PA system were known by Building 174 facility management, but not addressed. Corrective Actions #5 and #6 address the specific problems identified. Corrective Action #7 addresses the issue of the slow activation of the interlocked beam shutter.

A4B1C07 - Responsibility of personnel not well-defined or personnel not held accountable. Confusion on which target bay personnel (laser technician or researcher) could or should use the two-way radios may have contributed to the event. Corrective Action #8 will address this issue.

A4B1C08 - Corrective action responses to a known or repetitive problem was untimely. Building 174 management had realized that the use of the two-way radios as the only way to ensure personnel were out of the rooms was not ideal. Management also realized that the taped messages were occasionally played in the wrong room. Corrective Actions #5 and #6 will address these specific findings.

A4B2C06 - Means not provided to assure procedures/documents/records were of adequate quality and up-to-date. The shot sequence procedure was embedded in a larger "alignment" procedure and workers did not easily know where to go to access it. Procedure was not prepared in conformance with LLNL standards. Corrective Action #9 will require more formality on procedures throughout Building 174.

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### **23. Evaluation (by Facility Manager/Designee):**

As a result of this incident, PLS management commissioned the preparation of a management review. This management review included touring the facility, evaluating the affected systems, and interviewing key personnel that were associated with the event. The final report includes a discussion of apparent and root causes, findings, and recommendations.

The apparent cause was determined to be less than adequate communications. Proposed recommendations to correct identified deficiencies are relatively easy to implement (i.e., installing engineered controls to ensure personnel are evacuated prior to shots, modifying software, minimizing the use of radios for essential safety-related communications, and formalizing procedures or protocols on radio use).

The root cause is that the level of formality for facility operations was less than adequate. This lack of formality manifested itself in informal procedures, poorly defined roles and

responsibilities, and general work practices that were not as rigorous as they could be. These types of issues will take more attention and resources to correct than the apparent cause(s).

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**24. Is Further Evaluation Required?: No**

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**25. Corrective Actions**

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

1. Perform Causal Analysis - The PLS Directorate will perform an apparent cause analysis to identify the most probable cause(s) that explain why the event occurred. This analysis will be documented in the Final Occurrence Report.  

<b>Target Completion Date:</b> 01/30/2009	<b>Completion Date:</b> 01/29/2009
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2. Perform an Extent of Condition Review - The PLS Directorate will evaluate whether other areas (both within B174 and in other PLS facilities) have operations or systems that exhibit similar characteristics as the Callisto Target Bay.  

<b>Target Completion Date:</b> 02/20/2009	<b>Completion Date:</b> 02/12/2009
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3. Install a "Key Permissive" System to Ensure Personnel Have Vacated Target Bay - An engineered control (key permissive system) will be installed in the relevant target bays within B174 to ensure that the Janus laser can not fire until all personnel are out of the target bays.  

<b>Target Completion Date:</b> 02/27/2009	<b>Completion Date:</b> 02/12/2009
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4. Develop a More Formal Sweep Procedure - In conjunction with the key permissive system, a more formal sweep procedure/system is needed to ensure that personnel are out of the affected area and that other personnel cannot enter the room prior to the shot.  

<b>Target Completion Date:</b> 02/27/2009	<b>Completion Date:</b> 02/24/2009
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5. Develop and Implement a Radio Communication Protocol/Training - For the continued use of the two-way radios, a formal protocol shall be developed and presented to affected workers.  

<b>Target Completion Date:</b> 03/31/2009	<b>Completion Date:</b> 02/27/2009
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6. Synchronize the Pre-Recorded Messages with the Firing Sequence Program - The pre-recorded messages need to be synchronized with the shot firing sequence program to ensure that the messages are played in the correct target bay.  

<b>Target Completion Date:</b> 03/31/2009	<b>Completion Date:</b> 03/20/2009
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7. Improve the Performance of the Safety Interlock System in Callisto Target Bay - The interlock system in the Callisto Target Bay should be improved so that it cuts off the hazardous energy (laser) source in a more timely manner (contain laser light in the room).  

<b>Target Completion Date:</b> 03/31/2009	<b>Completion Date:</b> 03/20/2009
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|-----|--|---|------------------------------------|
| 8.  | Define Roles and Responsibilities - Clearly defined roles and responsibilities will be developed for all significant positions within the Jupiter Laser Facility, including the Laser Technician, Researcher, and Control Room Operator. | <b>Target Completion Date:</b> 03/31/2009 | <b>Completion Date:</b> 02/27/2009 |
| 9.  | Review Building 174 Procedures and Revise as Necessary - Procedures used in Building 174 shall be reviewed to ensure that they are clear and conform to LLNL standards. As necessary, procedures will be revised.                        | <b>Target Completion Date:</b> 04/15/2009 | <b>Completion Date:</b> 02/27/2009 |
| 10. | Perform an Effectiveness Review - An effectiveness review will be performed to evaluate the effectiveness of the corrective actions.   | <b>Target Completion Date:</b> 12/01/2009 | <b>Completion Date:</b> 11/24/2009 |

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## 26. Lessons Learned:

There are several lessons learned that can be gleaned from this event. From the root cause that was identified, procedures that have a direct impact on safety should be formalized and readily available to workers. Another lesson learned is that the use of two-way radios for essential, safety-related, activities should be discouraged or, when required, used in accordance with established and rigorous protocol. Finally, management should take prompt action on issues that are brought to their attention in order to minimize the possibility of a safety-related event from occurring.

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## 27. Similar Occurrence Report Numbers:

N/A

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## 28. User-defined Field #1:

No Injury, No Property Damage

## 29. User-defined Field #2:

S&T P&LS

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## 30. HQ Keyword(s):

01A--Inadequate Conduct of Operations - Inadequate Conduct of Operations (miscellaneous)  
 01F--Inadequate Conduct of Operations - Training Deficiency  
 01G--Inadequate Conduct of Operations - Inadequate Procedure  
 01N--Inadequate Conduct of Operations - Inadequate Job Planning (Other)  
 01P--Inadequate Conduct of Operations - Inadequate Oral Communication

01Q--Inadequate Conduct of Operations - Personnel error  
01R--Inadequate Conduct of Operations - Management issues  
08C--OSHA Reportable/Industrial Hygiene - Industrial Hygiene Exposure  
08K--OSHA Reportable/Industrial Hygiene - Near Miss (Other)  
12B--EH Categories - Conduct of Operations  
14B--Quality Assurance - Training and Qualification Deficiency  
14C--Quality Assurance - Quality Improvement Deficiency  
14D--Quality Assurance - Documents and Records Deficiency  
14E--Quality Assurance - Work Process Deficiency

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### **31. HQ Summary:**

On December 18, 2008, a researcher and a technician were working in the Callisto Laser Laboratory when the laser was prematurely fired. The presence of a designed obstruction in the beam path, which has to be removed before operations, blocked the majority of the laser power to the target chamber where the workers were located. The control room operator believed he received the "all clear" message from the workers. No eye damage was expected because of the obstruction and laser eyewear use. The nature of this particular shot also makes it highly unlikely that the employees were exposed to other potentially harmful radiation (i.e., x-rays). An investigation is ongoing.

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### **32. DOE Facility Representative Input:**

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### **33. DOE Program Manager Input:**

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### **34. Approvals:**

**Approved by:** Thomas Diaz de la Rubia, Facility Manager/Designee

**Date:** 01/29/2009

**Telephone No.:** (925) 422-6714