

# Occurrence Report

## After 2003 Redesign

Energy Research Programs (PNNL)

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(Name of Facility)

Laboratory - Research & Development

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(Facility Function)

Pacific Northwest National Laboratory

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Pacific Northwest National Laboratory

(Site)

(Contractor)

**Name:** Gilmore, T. J.

**Title:** Manager, Field Hydrology and Chemistry

**Telephone No.:** (509) 371-7171

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(Facility Manager/Designee)

**Name:** POLLARI, ROGER A

**Title:**

**Telephone No.:** (509) 371-7700

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(Originator/Transmitter)

**Name:** Pollari, R. A.

**Date:** 08/26/2010

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(Authorized Classifier (AC))

**1. Occurrence Report Number:** SC--PNSO-PNNL-PNNLBOPER-2010-0014

Researcher Receives Threshold Limit Value (TLV) Ultraviolet (UV) Exposure

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

	Date	Time
<b>Notification:</b>	06/28/2010	09:50 (ETZ)
<b>Initial Update:</b>	08/06/2010	12:09 (ETZ)
<b>Latest Update:</b>	08/26/2010	16:35 (ETZ)
<b>Final:</b>	08/26/2010	16:35 (ETZ)

**3. Significance Category:** 4

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**4. Division or Project:** Energy and Environment Directorate

**5. Secretarial Office:** SC - Science

**6. System, Bldg., or Equipment:** RTL520 / Room 126

**7. UCNI?:** No

**8. Plant Area:** RCHN Area

**9. Date and Time Discovered:** 06/22/2010 12:32 (PTZ)

**10. Date and Time Categorized:** 06/23/2010 09:16 (PTZ)

**11. DOE HQ OC Notification:**

Date	Time	Person Notified	Organization
NA	NA	NA	NA

**12. Other Notifications:**

Date	Time	Person Notified	Organization
06/23/2010	09:20 (PTZ)	Carlson, J. L.	PNSO

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

Researcher Receives Threshold Limit Value (TLV) Ultraviolet (UV) Exposure

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**14. Reporting Criteria:**

2B(6) - Personnel exposure to chemical, biological or physical hazards (e.g. noise, laser, ultraviolet light, heat, etc.) above limits established in 10 CFR Part 851, but below levels deemed immediately dangerous to life and health (IDLH).

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**15. Description of Occurrence:**

On June 21, 2010, an intern donned gloves, full-face shield, and laboratory coat and performed laboratory work utilizing an ultraviolet (UV) transilluminator. The staff member worked on and off at the instrument during the day for a total of approximately 30 minutes. On June 22, 2010, the intern noticed redness on their lower neck and reported the injury to management. The event was originally categorized as non-reportable on June 22, 2010; however, a follow-up investigation by industrial hygienists measured the UV intensity to be 20 microwatts/cm<sup>2</sup> by conservatively simulating and estimating staff exposure. At this intensity and wavelength the maximum exposure time (unprotected) was calculated to be approximately 2.5 minutes. Considering the UV intensity and length of time working at the instrument it was determined that the UV exposure was above the Threshold Limit Value (TLV).

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**16. Is Subcontractor Involved?** No

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

N/A

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## 18. Activity Category:

12 - Research

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## 19. Immediate Actions Taken and Results:

Work with the UV illuminator box was suspended until Worker Safety and Health completed an investigation and provided recommendations for restarting work. A critique was scheduled.

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## 20. ISM:

- 2) Analyze the Hazards
  - 3) Develop and Implement Hazard Controls
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## 21. Cause Code(s):

A3B1C01 - Human Performance Less Than Adequate (LTA); Skill Based Errors; Check of work was LTA  
-->couplet - NA

A5B3C01 - Communications Less Than Adequate (LTA); Written Communications Not Used; Lack of written communication

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## 22. Description of Cause:

An apparent cause and development of the following causal factors was performed by a PNNL Qualified Causal Analyst:

A3B1C01 - Human Performance LTA | Skill Based Error | Check of Work was LTA (See corrective actions #1 & 4.)

"How Do I" (HDI) Standards Based Management System (SBMS) Noncompliance - Hazard not identified and the appropriate hazard mitigations were not developed:

The event occurred when an intern donned personal protective equipment (PPE) and began excising DNA fragments in agarose gel; the gel was placed on a UV transilluminator box to visualize the DNA bands. The intern spent approximately 30 minutes bent over the UV transilluminator while excising gel fragments and did not realize that she was receiving exposure under the bottom of the face shield. Tests performed after the event indicated that when no PPE is worn, the maximum exposure time at 14" with a maximum intensity setting on the transilluminator is 23 seconds. The illumination typically used for viewing is ~ 1/2 of maximum setting, resulting in a maximum exposure time of 2 1/2 minutes. It is estimated that the intern was using the 1/2 of maximum setting while excising the gel fragments. During the discussions that took place after the exposure, it was discovered that the UV transilluminator had not been identified as a hazard in the Hazard Awareness Summary (HAS) for lab 126 and therefore, a non-ionizing radiation (NIR) permit was not implemented in the laboratory. The Cognizant Space Manager (CSM) indicated it was an oversight. She has a similar piece of equipment in an adjacent lab that she had identified the hazard in the HAS, but inadvertently left it off of the HAS for lab 126.

If the CSM had identified the transilluminator as a hazard in the HAS it would have prompted a NIR permit. The NIR permit development and approval process requires the Laser Radiation Officer to review the scope of work and the non-ionizing source. The emitter characteristics would be described in the approved permit, along with the hazards, engineering controls, administrative controls (including length of exposure), standard requirements, personal protective equipment, description of emergency response, and emitter user awareness.

After the exposure occurred the HAS was annotated with the non-ionizing radiation hazard and an NIR permit was developed. The NIR permit established the appropriate controls for the transilluminator box in lab 126 including the required use of a UV rated face shield and protective covering of exposed skin on the face, neck, and hands when using the UV box. In addition, a control area was established for the NIR source to limit the exposure of the radiation to only those within the control area. The immediate area (8') around the UV box to include adjacent bench space needs to be clear of other personnel and activities while the UV box is in use. The approved NIR permit provides a description of personal protective equipment. UV eye protection, UV face shields and protective covering of exposed skin on the face, neck and hands are required when using the UV box. It goes on to state, face shield and lab coat should be fitted and adjusted to provide protection to exposed skin including the face and neck when standing over the UV box in a standard working position.

Additional opportunities to catch the absence of the NIR permit and thereby avoid the event may have been missed. These opportunities include: the task mentor not recognizing the absence of a NIR permit during task preparation activities with the intern and during discussions regarding donning and use of appropriate PPE with the intern. Had the task mentor given it more thought or consideration, he/she may have discovered the NIR permit was missing from the lab's HAS.

If the hazard had been identified in the HAS and the required NIR permit developed, the appropriate hazard mitigations would have been established eliminating the UV exposure by allowing the intern to have a clear understanding of the length of time permitted for work with the UV transilluminator as well as the requirement that PPE must cover all exposed skin.

A5B3C01 - Communications LTA | Written Communication Not Used | Lack of Written Communication  
(See corrective actions #2 & 3.)

Communications regarding the use of personal protective equipment (PPE) to make sure all exposed skin surfaces were covered appropriately was less than adequate.

The PPE worn did not provide full coverage of all exposed skin areas. The laboratory coat worn did not have a collar or neck guard to provide full coverage of the neck area. In addition, the face shield may not have been long enough or was not properly positioned to assure full coverage of the neck area. This resulted in a strip of skin ~1/8 of an inch wide and 2 1/2 inches long becoming overexposed.

Because the PPE donning requirements were communicated verbally by other research staff and did not emphasize the importance of making sure all skin areas were covered there was a lack of attention to detail and verification that all skin surfaces were covered appropriately.

Without the non-ionizing radiation hazard identified in the HAS and the lack of a NIR permit, the importance of wearing the PPE appropriately was understated and resulted in the intern receiving an overexposure to the neck area.

The updated HAS and the new NIR permit for this lab clearly identify the UV hazard and communicate to the

staff working with it the type of PPE needed, as well as the importance of wearing it correctly to cover all exposed skin surfaces.

Note: the methodology used to determine causal factors was DOE Guide 231.1-2, Occurrence Reporting Causal Analysis Guide.

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

On June 21, 2010, an intern donned gloves, full-face shield, and laboratory coat and performed laboratory work utilizing an ultraviolet transilluminator. The intern worked on and off at the instrument during the day for a total of approximately 30 minutes. After the intern reported the redness on their neck, a follow-up investigation by industrial hygienists measured the UV intensity to be 20 microwatts/cm<sup>2</sup> by conservatively simulating and estimating staff exposure. At this intensity and wavelength the maximum exposure time (unprotected) was calculated to be 2 1/2 minutes. Considering the UV intensity and length of time working at the instrument it was determined that the UV exposure was above the TLV.

Investigation results revealed the Hazard Awareness Summary (HAS) developed by the CSM for the laboratory had not identified the UV hazard and therefore, a Non-ionizing Radiation (NIR) permit for use of the equipment had not been developed. Verbal communications provided to the intern regarding PPE did not adequately convey the importance of full skin coverage to prevent exposure while working with the UV transilluminator. The PPE worn by the intern did not provide full coverage due to inadequate adjustment (faceshield) by the intern and improper selection of PPE (laboratory coats without neck collar/shield) for use with the UV transilluminator.

This event did not impact facility condition or ongoing programs.

Review of Similar Occurrences (see Item 37):

None

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

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### 25. Corrective Actions

**Local Tracking System Name:** Assessment Tracking System

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| 1. | Complete IOPS hazard evaluation for RTL520, laboratory 126 to assure the Hazard Awareness Summary appropriately identifies UV hazard within the work space and a corresponding non-ionizing radiation permit is prepared and approved. |
|    | Objective evidence of Completion: Revised Hazard Awareness Summary with id of UV hazard and an approved non-ionizing radiation permit.   |
|    | <b>Target Completion Date:</b> 07/23/2010  |
|    | <b>Tracking ID:</b> ATS # 53785.1.2  |
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|----|--|
| 2. | Discuss with EED Chief Operating Officer the need for a lab-level review of UV exposure controls for staff performing field studies and if agreed, determine which organization should own it. |
|    | Objective evidence of Completion: Documentation in the Assessment Tracking System (ATS) of a signed and dated memo from action owner identifying the involved parties and the results of the   |

discussion.

Results: The Offsite Safety Plan requirement for field work includes addressing all hazards encountered at the work location, including UV exposure. Each Safety and Health Representative, along with project staff, reviews the hazards and determines the appropriate mitigation. In addition, two Offsite Safety Plans were reviewed to understand the identification and mitigation of the UV exposure hazards. Based on the requirement that all offsite work have an Offsite Safety Plan, and a review of the two plans, management has determined that the UV exposure is being addressed for field work. In addition, action #5 below is established to review the NIR program with respect to outdoor UV radiation.

**Target Completion Date:** 07/30/2010

**Tracking ID:** ATS # 53785.1.3

3. Develop a formal lessons learned about this event and distribute it to CSMs/owners of UV sources as well as publish it on PNNL's Lessons Learned Website.

Objective evidence of Completion: List of the CSMs / owners of UV sources, copy of the email distributing the lessons learned to the designated individuals, and a copy of the Lesson Learned when released on the internal PNNL Lessons Learned site

**Target Completion Date:** 09/30/2010

**Tracking ID:** ATS # 53785.1.4

4. The Technical Group Manager will discuss, with both the Cognizant Space Manager and the researcher present with the intern during this exposure event, the need to do a complete and thorough review of existing hazards when completing the routing lab hazards assessment or developing a new HAS.

Objective evidence of Completion: TGM will document in ATS, with the appropriate level of detail, the completion of this action.

**Target Completion Date:** 08/31/2010

**Tracking ID:** ATS # 53785.1.5

5. The WSH Programs Organization will review the Non-Ionizing Radiation (NIR) program to ensure that Laboratory NIR hazards, including outdoor UV radiation, is appropriately captured.

Objective evidence of Completion: WSH will document the results of the review in ATS with the appropriate level of detail, and further actions taken as result of this review.

**Target Completion Date:** 10/31/2010

**Tracking ID:** ATS # 53785.1.6

## 26. Lessons Learned:

Lessons learned from this event include the following:

- Proper identification of the hazard in the IOPS Hazard Assessment Summary process and development of mitigation strategies with Subject Matter Expert involvement would have prevented this occurrence.
- Communication on how the intern should don the PPE was less than adequate, the intern was not fully aware that donned PPE needed to provide full skin coverage.

## 27. Similar Occurrence Report Numbers:

None

**28. User-defined Field #1:**

ATS # 53785.1

**29. User-defined Field #2:**

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**30. HQ Keyword(s):**

01A--Inadequate Conduct of Operations - Inadequate Conduct of Operations (miscellaneous)  
01N--Inadequate Conduct of Operations - Inadequate Job Planning (Other)  
01P--Inadequate Conduct of Operations - Inadequate Oral Communication  
01R--Inadequate Conduct of Operations - Management issues  
08C--OSHA Reportable/Industrial Hygiene - Industrial Hygiene Exposure  
08H--OSHA Reportable/Industrial Hygiene - Safety Noncompliance  
11I--Other - Visiting Scientist/Researcher or Student Employee  
12J--EH Categories - OS/IH  
13F--Management Concerns - Operating Experience Summary Article  
14D--Quality Assurance - Documents and Records Deficiency  
14E--Quality Assurance - Work Process Deficiency

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**31. HQ Summary:**

On June 22, 2010, a staff member (intern) noticed redness on their lower neck the day after performing laboratory work using an ultraviolet transilluminator. The staff member was wearing gloves, full-face shield, and laboratory coat and had worked on and off at the instrument during the day for approximately 30 minutes. The staff member reported the injury to management. A follow-up investigation by industrial hygienists measured the UV intensity to be 20 microwatts/cm<sup>2</sup> by conservatively simulating and estimating staff exposure. At this intensity and wavelength, the maximum exposure time (unprotected) was calculated to be 2.5 minutes. Considering the UV intensity and length of time working at the instrument, industrial hygienists determined that the UV exposure was above the TLV. Work with the UV illuminator box was suspended until Worker Safety and Health completes an investigation and provides recommendations for restarting the work. A critique was scheduled.

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**32. DOE Facility Representative Input:**

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**33. DOE Program Manager Input:**