Department of Energy
Office of Science
Washington, DC 20585

Office of the Director

September 7, 2004

MEMORANDUM FOR DISTRIBUTION

FROM: MILTON D. JOHNSON
CHIEF OPERATING OFFICER

SUBJECT: Electrical Safety Action Plans

Thank you for your efforts in responding to my May 24, 2004, memorandum, subject: Department of Energy Electrical Safety Month. The electrical safety action plans that you developed, and more importantly, the actions themselves are a good beginning. As stated in my memorandum, our goal is for each laboratory to take action to improve performance in electrical safety and to demonstrate significantly improved performance within one year. This memorandum provides feedback on the plans that were submitted and describes our path forward.

The May 24 memorandum outlined a two-pronged approach:

1. Apply lessons learned to improve operations, especially lessons learned from the Office of Environment, Safety and Health (EH) lessons-learned report; and
2. Correct OSHA-identified deficiencies to improve the physical condition of the laboratories.

Lessons Learned Applied to Operations

A good example of a careful review of the EH lessons-learned report and development of a comprehensive set of corrective actions is the attached plan submitted by the Pacific Northwest National Laboratory (PNNL). It is unclear from most site plans if such a comprehensive review or any other review of lessons learned outside the laboratory was conducted. It is important that we do an introspective examination of events to ensure that they do not happen again. Taking such a step is important, but there is also the need to go beyond events within your laboratory and look at the experiences throughout the complex.

Looking outside your laboratories for lessons learned will enable you to identify unanticipated vulnerabilities, apply lessons learned, and improve performance. The majority of plans provided descriptions of current electrical safety programs and histories of what was done in previous years with little focus on the future.

Key attributes of a strong safety culture are the ability to know you can always improve through benchmarking and seeking out best practices and lessons learned. Therefore, I recommend that you review the approach taken by PNNL and apply their approach, as appropriate, to your improvement agenda.

There is no need to produce or submit a revised plan as members of my staff will be conducting follow-up communications with your staff to address specific questions.

Improving the Physical Condition

All laboratories indicated that they are well on their way to correct all of the OSHA-identified deficiencies. Current progress ranges from 20 to 90 percent complete. All but two laboratories indicated they would correct all of their OSHA-identified deficiencies in time frames ranging from August 2004 to September 2005. We will be seeking more information from those laboratories that did not provide a completion schedule.

As you further refine your corrective actions, we expect the laboratories to demonstrate continued improvement in electrical safety. Laboratories will be held accountable for the success of the Electrical Safety Campaign.

If you have any questions or would like to discuss ways to improve your specific plan, please contact Rosalie Brown at 301-903-2021.

Attachment

Distribution:
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Background

A recent correspondence from the U.S. Department of Energy (DOE) Office of Science (SC) identified an unacceptably high rate of electrical occurrences throughout the SC laboratories. The SC requested that Pacific Northwest National Laboratory (PNNL) develop a plan to address electrical safety improvements and lessons learned.

The plan should include:

- Actions that will be taken to improve operations based on a review of the nature of electrical safety occurrences at PNNL and available lessons learned.
- A summary-level schedule for correcting the electrical safety hazards recently identified by OSHA.

This Electrical Safety Improvement Plan is PNNL's response to DOE's request.

History of Safety Improvements

1998-2000:

Battelle hired an external assessor to measure how effectively PNNL was providing an electrically safe workplace for its employees. This assessment resulted in a major lab-level improvement initiative with the following significant elements.

- Hired a dedicated subject matter expert to maintain a well-defined and technically sound electrical safety program.
- Formed a PNNL Electrical Safety Committee to assist in developing technical standards.
- Developed lab-level electrical safety technical standards based on the DOE Electrical Safety Handbook.
- Developed a training course and refresher training.

The following action items were identified to improve the Lessons Learned program and were implemented in 2000:

- Developed a PNNL internal web system for dissemination of lessons learned information.
- Established an electrical safety web-site for lessons learned dissemination to staff and DOE.
- Develop a program to trend electrical safety incidents at the site.
- Establish a positive method of assessing electrical incidents.
- Established a requirement to report all incidents. "There is no penalty for over reporting" electrical incidents.

2001-2002

A subsequent external assessment identified minor improvement items that were implemented.

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2003-2004

A PNNL researcher received an electrical shock while working on energized research equipment during experiment/test preparation. The root cause of the event was that electrical hazards for the equipment were not adequately recognized, evaluated, or controlled, including a lack of recognition of the electrical work requirements by the researchers and a lack of evaluation by the Cognizant Space Manager, Subject Matter Expert and management. The following are the significant corrective actions:

- An assessment tool was developed and a laboratory-wide review of high risk electrical equipment was conducted with line management and safety experts. The results of the reviews were documented and they form a baseline of comparison for future reviews and deficiencies identified during ongoing walkthroughs.
- Procedures were clarified.
- Training was enhanced.

1998-Present

The PNNL Electrical Safety Subject Matter Expert continually screens incoming lessons learned for applicability and develops appropriate PNNL specific lessons learned and actions determined from the screening. This is an ongoing process, which results in improvement activities in addition to those identified through self-assessment activities.

Gap Analysis and Corrective Actions

The PNNL Electrical Safety Committee and the Electrical Safety Engineer performed a gap analysis comparing the results of lessons learned/electrical occurrences to PNNL policy and procedure. (Attachment 1)

The following lessons learned/occurrences were reviewed:

- DOE April 2004 Operating Experience, Lessons Learned report
- RL-PNNL-PNNLBOPER-2003-0009
- RL-PNNL-PNNLBOPER-2004-0001
- RL-PNNL-PNNLBOPER-2001-0021
- RL-PNNL-PNNLNUCL-1997-0017

Corrective actions and improvement items were identified to address gaps and improvement opportunities and due dates were assigned. (Attachment 2)

Actions are being tracked in the PNNL Assessment Tracking System (ATS). The actions include improvements to the self-assessment process that will allow PNNL to validate program effectiveness.

Electrical Safety Hazards Recently Identified by OSHA

In September 2003, OSHA performed a special inspection of the PNNL DOE facilities as part of a congressional mandate to evaluate the potential cost of external regulation. 220 electrical discrepancies were found. To date 69% have been corrected and 31% are open and scheduled for completion by the end of FY04 (see Attachment 2, Item 19).

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Gap Analysis

Gap #	DOE Electrical Safety Operating Experience & Lessons Learned	Is it in PNNL Requirements?
	OSHA regulation 29 CFR 1910.147(a)(3)(i) states: "This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start up or release of stored energy in order to prevent injury to employees."	YES See Attachment 2, Item 1
	OSHA regulation 29 CFR 1926.333(b)(2) *Lockout and Tagging*, states: "While any employee is exposed to contact with parts of fixed electric equipment or circuits which have been de-energized, the circuits energizing the parts shall be locked out or tagged or both in accordance with the requirements of this paragraph."	YES See Attachment 2, Item 2
	Walk down the work site to (1) identify equipment to be worked on, (2) ensure that equipment to be isolated is clearly marked, (3) verify or modify drawings to reflect as-built conditions, and (4) identify additional hazards or other safety issues.	YES See Attachment 2, Item 4
1	For decommissioning work, re-evaluate electrical hazards as systems and equipment are dismantled and isolations are removed.	NO See Attachment 2, Item 8
	Ensure that lockout/tagout procedures or work instructions include a zero-energy check to confirm the effectiveness of the lockout/tagout installation. Always perform a zero-energy check on the circuit to be worked, as well as on other nearby circuits and terminals. Perform these checks any time new areas or equipment are accessed.	YES
	Upon completion of wiring work, check for proper voltages, phasing, and grounding.	YES
	Use lockout/tagout processes if there is a possibility that work may be performed in close proximity to energized electrical conductors.	YES See Attachment 2, Item 2
	Ensure that lockout/tagout procedures or work instructions include independent verification that the lockout/tagout has been correctly performed.	YES
	Ensure that purchased electrical components and equipment are acceptance-tested before they are put into service.	YES
	Work on energized circuits should be performed only after obtaining special approvals and developing job-specific safety controls.	YES See Attachment 2, Item 2
	Always use electrical-rated personal protective equipment (e.g., insulated gloves and boots, ground-fault circuit interrupters, double-insulated tools, and rubber mats) when working on energized electrical circuits and equipment (required by 29 CFR 1910.335 (a)(1)(i)).	YES
	Stop work if an unanticipated electrical hazard or condition is encountered and seek appropriate assistance.	YES
	In work areas where the exact location of underground electric power lines is unknown, employees using jackhammers, bars or other hand tools, which may contact a line shall be provided with insulated protective gloves.	YES See Attachment 2, Item 9

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Gap #	DOE Electrical Safety Operating Experience & Lessons Learned	Is it in PNNL Requirements?
	29 CFR 1926.416(a)(3) states: "Before work is begun the employer shall ascertain by inquiry or direct observation, or by instruments, whether any part of an energized electric power circuit, exposed or concealed, is so located that the performance of the work may bring any person, tool, or machine into physical or electrical contact with the electric power circuit. The employer shall post and maintain proper warning signs where such a circuit exists. The employer shall advise employees of the location of such lines, the hazards involved, and the protective measures to be taken."	YES
	29 CFR 1926.651(b)(1) states: "The estimated location of utility installations, such as sewer, telephone, fuel, electric, water lines, or any other underground installations that reasonably may be expected to be encountered during excavation work, shall be determined prior to opening an excavation."	YES
	29 CFR 1926.651(b)(2) states: "Utility companies or owners shall be contacted within established or customary local response times, advised of the proposed work, and asked to establish the location of the utility underground installations prior to the start of actual excavation."	YES
	Mark all concealed electrical wiring when located.	YES
2	Drill pilot holes and penetrate no deeper than is required for the job.	NO See Attachment 2, Item 9
3	Check drill holes frequently for obstructive material, such as wire fragments or rebar.	NO See Attachment 2, Item 9
4	Always wear personal protective equipment.	NO See Attachment 2, Item 9
5	Clearly mark components that are to be removed and establish boundaries and hold points for zero energy verification when performing demolition work.	NO See Attachment 2, Item 9
6	Conduct source checks for energy near the work, and not just at "known" energy sources.	NO See Attachment 2, Item 9
	Exercise "stop work authority" if unanticipated conditions are encountered.	YES
	Use appropriate personal protective equipment that has proper electrical ratings.	YES
	Standardize methods for identification and location of concealed or buried electrical utilities.	YES
	M&O contractors should share information such as locator data, drawings, and permit information with subcontractors performing the work.	YES See Attachment 2, Item 5
	Analyze the specific work activity and do not just base hazards controls on established standards and work practices.	YES
7	Perform excavation and penetration work in a timely manner following surveys and marking of locations. Markings can deteriorate over time, and conditions can change.	NO See Attachment 2, Item 9 & 10
	Employ utility locator services or use the latest survey technology available.	YES

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Gap #	DOE Electrical Safety Operating Experience & Lessons Learned	Is it in PNNL Requirements?
	Hand-excavate in close proximity to the expected location of the utility rather than using excavation equipment.	YES
8	Re-evaluate hazards analysis processes and associated controls for excavation and electrical penetration-type work.	NO See Attachment 2, Item 9
9	Place marking tape or electronic markers above newly installed utilities or excavated utilities to aid in future identification.	NO See Attachment 2, Item 9
10	OSHA regulation 29 CFR 1910.333©(3)(III)(A) states: "Any vehicle or mechanical equipment capable of having parts of its structure elevated near energized lines shall be operated so that a clearance of 10 feet is maintained."	NO See Attachment 2, Item 5
	OSHA regulation 29 CFR 1910.550(A)(15)(IV) states: "A person shall be designated to observe clearance of the equipment and give timely warning for all operations where it is difficult for the operator to maintain the desired clearance by visual means."	YES See Attachment 2, Item 5
	Institute of Electrical and Electronic Engineers *Standards for Overhead Conductor Clearance*, Part 2, Table 232-1 requires that for roads and other areas subject to truck traffic, the maximum sag for wires, conductors and cables is a height of 15.5 feet.	N/A Hanford site utilities maintain, and install the overhead power lines.
	Job hazard analyses for tasks involving vehicles need to include all work areas and travel routes to identify overhead electrical hazards and to address appropriate requirements for vehicle clearance and an adequate number of spotters.	YES
	Job hazard analyses should also consider the possibility of changed vehicle profiles and load configurations, such as raised truck beds, the shifting of masts and booms, and the increased heights of vehicles after unloading.	YES
	Spotters assigned to transports need to be dedicated for the whole job, including exiting.	YES
	Drivers must be trained to stay in communication with spotters and to be aware of the effect of changed vehicle and load configurations on clearances.	YES
11	Guy wires, utility poles and overhead lines need to be marked if not clearly visible to drivers and spotters.	NO See Attachment 2, Item 5
	When performing tasks that may involve electrical hazards, roles and responsibilities should be clearly defined, understood, and reviewed before beginning work. This includes the rights and responsibilities to stop work.	YES

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Corrective Action Schedule

Improvement Goal: Develop processes to improve electrical hazards recognition, evaluation and controls.				
Item	Gap #	Corrective Action	Due Date	ATS #
1		Add a self-assessment checklist item under "General" hazards that asks Cognizant Space Managers (CSMs) to verify that electrical hazards are properly guarded and that staff are using the guards (and not removing guards from energized electrical equipment without appropriate assessment and permits and/or lockout-tagout).	September 2004	5605
2		Add the building manager to the list of required approvals on the *Energized Electrical Work Permit.*	October 2004	5400
3		Add a section in the *IOPS Handbook* for each facility that addresses the hazards of electrical equipment and the prohibition from removing guards from electrical equipment.	December 2004	5605
4		Develop an electrical walk-through hazard checklist, which identifies electrical violations, such as; guarding of live parts, access to panels, breakers and disconnects and temporary power used for permanent wiring.	July 2004	5078
5	10, 11	Use the lessons learned process, IOPS, Inside PNNL, and DOE NNSA Daily Lessons Learned as a source of electrical safety information for staff, vendor, contractors and sub-contractors. Add a lesson learned on penetration, overhead power lines and intrusion to *PNNL Lessons Learned* data base.	July 2004	5605
7		Revise the *IOPS Hazard Awareness Summary* to include examples of electrical hazards occurring during activities performed in labs (e.g., remove covers on electrical equipment and perform voltage measurements).	December 2004	5605
8	1	Revise SBMS and electrical worker training to include a section for mitigating electrical hazard as electrical equipment is dismantled and removed from service.	August 2004	5605
9	2, 3, 4, 5, 6, 7, 8, 9	Revise the *IOPS Blind Penetration* procedure to include a section on PPE, engineering and administrative controls.	July 2004	5605
10	7	Add a requirement for performing excavation in a timely manner and scanning before driving electrical ground rods to the excavation procedure.	July 2004	5605
11		Issue direction to Technical Group Managers to increase frequency of management involvement in lab walk-thoughs, including reviewing IOPS checklists with CSMs annually and using activity-based self-assessments.	July 2004	5605
12		Assign construction managers the task of providing current lessons learned for construction force.	July 2004	5605
13		Develop an assessment checklist to include information on the cause of electrical deficiencies.	August 2004	5078

Item	Gap #	Corrective Action	Due Date	ATS #
14		Brief electrical crafts on the requirement for *Examining Unlisted or Custom Fabricated Equipment.*	June 2004	5605
15		Revise IOPS to include requirements for inspection of modified or unlisted equipment.	July 2004	5605
16		Develop a matrix to track and trend the cause of electrical findings.	July 2004	5078
17		Develop job specific "OJT" training matrix for electrical workers and non-electrical workers that addresses cord plug control, EEWP, PPE, electrical hazard recognition, assessment and control.	February 2005	5605
18		Develop a distribution list of managers and space managers that supervise R&D electrical workers, and use this distribution list to disseminated lessons learned to staff.	July 2004	5605
19	N/A	Correct OSHA electrical deficiencies	Sept 2004	5474

Note: All action items will be tracked in the PNNL Assessment Tracking System (ATS).