



**Department of Energy
Princeton Site Office**
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July 30, 2004

Milton D. Johnson
Chief Operating Officer
SC-3, FORS, HQ

SUBJECT: ACTION: DEPARTMENT OF ENERGY ELECTRICAL SAFETY
MONTH MEMO, M. JOHNSON TO DISTRIBUTION, May 24, 2004

ISSUE: Electrical Safety Performance Improvement

My safety staff and I have reviewed the attached letter and find it to be an accurate depiction of Princeton Plasma Physics Laboratory's (PPPL) continuing effort to improve the safety for workers exposed to electrical hazards at our site.

While the goal of any manager is zero incidents or accidents, the Laboratory Director and I both understand that the effort toward such a goal is never-ending, and achievements are best regarded as temporary. The philosophy of Princeton Site Office in safety oversight is that a participative approach is more likely to prevent an occurrence, than is an after-the-fact, historical or investigative approach.

Our safety audits include a multi-level approach: Walkthrough Surveillances, Mini Reviews, and Unified Safety Reviews. In addition, we have a long standing practice of participation in safety hazard analysis, work planning review, and direct observation of significant or critical construction and maintenance events.

Walkthrough Surveillances are conducted either solo by my staff members, or in conjunction with PPPL Management. They are broad in scope, and use the principle that many eyes, particularly those of people who are not normally engaged in work within the area of inspection, are most likely to spot a safety discrepancy. On some occasions, we will team with PPPL staff when our fact-sharing reveals that common concerns have developed and parallel investigations would be less effective.

We also make every attempt to be on hand to observe critical construction and maintenance events at a safe distance, in order to lend an extra set of "eyes", and hopefully spot the not-so-obvious hazard.

Mini reviews are focused mini audits of a specific concern or issue and, are informal, brief descriptions of perceived issues, usually involving the participation of knowledgeable laboratory personnel. More often than not, they identify that the laboratory personnel have appropriately addressed the concerns, but the intent of Mini Reviews is to avert just one incident, accident, or program flaw.

Unified Safety Reviews (USRs) are led by PSO staff, teaming with PPPL staff. USRs attempt to involve all of the planning and execution elements of a formal process audit.

Very similar to USRs, and to the laboratory management's credit, are the PPPL formal Q/A Audits conducted for PPPL Management clients, in which PSO staff are invited to participate. PPPL Q/A Audits comply fully with American Society for Quality and other internationally-recognized standards. These audits, led by the PPPL Q/A Division, are an internal effort conducted for the laboratory management client. PSO team members serve at my direction on the PPPL Q/A Manager's team and sign the report. The audit report results are not divulged outside of the team, except by permission of the client. While this may seem an odd approach to objective federal oversight, it allows me to gain an insight into laboratory-identified problems we might not otherwise have immediate knowledge of, participate in solutions, and augment the laboratory's Q/A capability. Both the laboratory management and I view this as a win-win situation – that of enhanced (integrated) safety program management.

Finally, and of paramount importance, PPPL top management is characterized by a willingness to take ownership and responsibility for site safety, which has had a palpable impact upon the safety focus of the worker during job performance.



Jerry Wm. Faul, Manager
Princeton Site Office

Enclosure:

July 29, 2004 letter

cc: J. Larson, SC-83, GTN, HQ w/encl.
R. Goldson, PPPL w/encl.
J.W. Anderson, PPPL w/encl.
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Mr. Jerry Wm. Faul, Manager
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July 29, 2004

Dear Mr. Faul:

Subject: Electrical Safety

Reference: Letter, M.D. Johnson to Distribution, May 24, 2004, *Department of Energy Electrical Safety Month*

We have reviewed the referenced letter from Dr. Johnson and share his interest in the importance of electrical safety and the goal of demonstrating improved performance one year from now. In accordance with the request, we have reviewed: (a) the fundamentals of the electrical safety program at PPPL; (b) Lessons Learned from operations; and (c) the effect of the physical infrastructure on electrical safety. A summary of our review follows along with an action plan that outlines in-process and upcoming initiatives designed to further improve our electrical safety program.

Electrical Safety Program at PPPL

Policy and Procedures

The electrical safety program at PPPL is considered to be mature and robust. Electrical safety requirements and work practices figure prominently in design, construction, testing, operation, maintenance and decommissioning activities. Likewise, the principles and functions of integrated safety management are essential to the effective implementation of our electrical safety program and have been fully developed. PPPL Procedures and Policies govern the controls that must be employed to address electrical safety issues, which include Lockout/Tagout, Hazard Analysis, Work Planning, and Operations Authorization. Electrical safety policies and required practices are specified in the PPPL Environment, Safety & Health (ES&H) Manual. Policies and requirements are derived from the National Electrical Code (NEC), National Electrical Safety Code (NESC), OSHA standards, relevant DOE Orders, and NFPA 70E (Standard for Electrical Safety Requirements for Employee Workplaces).

Over the last several years, important enhancements have been instituted to promote the importance of worker safety and to develop the skills of our staff in the recognition and control of all hazards (including electrical hazards). In many respects, these initiatives have also worked to improve the electrical safety program. A noteworthy example involves the development and refinement of a formalized Work Planning process. Many Laboratory activities require the preparation and completion of reviews, work planning, hazard analyses, and controls to properly manage the work. The Work Planning process establishes the criteria by which work planning will proceed, integrating safety into all work planning, organizing the avenues by which changes will be planned, prepared, reviewed, implemented and documented into a systematic whole, and providing key cross references to other PPPL procedures.

Training

Proper and adequate training are of paramount importance for workers potentially exposed to electrical hazards. Beyond the requirement to ensure that workers are appropriately qualified to perform their work, several recent training initiatives have been taken which include:

Electric Utilization Training (EUT) – Following the release of a new NFPA Standard (70E *Standard for Electrical Safety Requirements for Employee Workplaces*) PPPL designed a new, detailed training program that is focused on workers who can be exposed to electrical hazards. This training is supplemental to General Employee and Basic Electrical Safety training courses that are also provided to our staff. The EUT course covers protection to the employee from electrical hazards such as shock, arc blasts and explosions initiated by electricity. Electrical dangers such as shock, electrocution, arc flash, and arc blast are prevalent, but proper training and safety strategies eliminate (or greatly minimize) the likelihood of injuries. The PPPL standard consists of safety related installation requirements, work practices, maintenance requirements, and requirements for special equipment. It covers electric conductors installed within or on buildings or other structures, conductors connecting installations to electric supply, and outside conductors. This training program has been recognized for its usefulness and it has even been provided to the staff at other DOE Laboratories.

Hazard Awareness Training – This year, PPPL instituted a new training course titled “Hazard Awareness” which was designed in response to employee feedback that additional training was warranted for members of the staff to become more adept at recognizing (and correcting) hazards in the field. The course is focused on small groups (~10) and includes classroom training as well as a hazard analysis workshop in the field. The Hazard Awareness Training course was designed to improve and expand the use of Job Hazard Analyses. It includes discussion of electrical hazards and appropriate controls, such as Ground Fault Circuit Interrupters, proper use of temporary/flexible wiring, and Lockout/Tagout. The course stresses the necessity of worker involvement in the identification of hazards as well as the importance of worksite inspections as a prerequisite of a successful Job Hazard Analysis. The initial courses have been focused on work groups that face routine hazards in their daily jobs (e.g., maintenance technicians, machine technicians, etc.). Future courses will expand to include other work groups, supervisors, and managers, as well.

Graduate Student Training – Each year, the Deputy Director sponsors a training course for PPPL graduate students which addresses ES&H issues in the workplace. This training program includes sessions on hazard analysis and recognition in experimental areas and it also includes explanation and information pertaining to electrical hazards and controls.

Lessons Learned

Lessons Learned from PPPL electrical safety incidents

PPPL has incorporated lessons learned from three on-site electrical safety incidents that have taken place since 1997 into its programs, processes and activities. Although no injuries resulted from any of these events, they were addressed as being very serious. A brief summary of each of the incidents follows:

Description of incident #1

An unknown receptacle box that had utilized a common conduit (but different circuit) with the other receptacles in a room was hidden behind equipment that was to be removed. It was believed that all equipment had been de-energized, but when the wires were cut in the common conduit, an arc was seen.

Causes

It had been assumed that all wires in the conduit were de-energized. No field checks were made to verify this condition prior to cutting them.

Preventive Measures Taken

Work was stopped. The PPPL ES&H Manual was revised to require specific precautions to be implemented for safing and removal of all wires and equipment, including field verification that they are de-energized prior to cutting and removal. These precautions are now included in all procedures prepared for these activities.

Description of incident #2

A subcontractor cut through an energized 480 Volt line while cutting a trench in the concrete floor inside a building.

Causes

Drawings for the building did not clearly show the 480 Volt line. AC power subject matter experts were only sporadically involved in work planning. Grounding and personal protective equipment (PPE) were not specified for the work.

Preventive Measures Taken

Work was stopped. A new Laboratory procedure on core boring, cutting and drilling was issued to specify proper PPE and grounding requirements for this kind of work. An existing procedure on digging permits was revised to require subject matter experts to review the work scope and pertinent drawings, and to perform walk downs of the work site prior to start of activities. All work requires preparation of job hazard analyses to identify hazards and protective measures, and to inform workers at the start of work. Additional equipment was procured to help locate conduit buried within concrete.

Description of incident #3

A subcontractor installing fire protection conduit in the drop ceiling of a room found that he needed to shorten a conduit run previously installed. He identified the wrong conduit and cut into a conduit with an energized 120-volt cable.

Causes

The worker's vision and access to the work area was restricted.

Preventive Measures Taken

Work was stopped. PPPL policy and practices were revised to require that cutting of conduits normally be performed on the floor. All measurements and fit-ups must be done prior to conduits being installed overhead, where possible. Any conduit cuts not being made on the floor and being cut in place require that the conduit being cut be marked and that a second person verifies that the right conduit has been identified for cutting.

Lessons Learned from other internal and external sources

In addition to lessons learned from our own on-site experience, PPPL incorporates lessons learned from events experienced around the DOE complex. These lessons are communicated via DOE through the site Office and through other mechanisms such as the DOE-EH *Society for Effective Lessons Learned Sharing* (SELLS) Program. Coupled with our own experiences, PPPL has instituted additional programmatic changes involving our safety program. Several examples are outlined:

- Excavation safety – Several instances at other facilities where excavations revealed unforeseen/undocumented buried electrical systems. PPPL has reviewed and modified its processes and procedures to clarify roles and responsibilities, and to institute the use of Ground Penetrating Radar during the digging permit planning process to help locate/identify undocumented buried items.

Control of Subcontractors – Experience at both PPPL and at other DOE facilities has indicated the need for heightened involvement and oversight of work performed by subcontractors. PPPL procedures and methods used to manage subcontracted work have undergone significant improvement over the past 18 months.

In addition, there are additional feedback systems used to gather information from employees related to our safety programs (including electrical safety issues.). These include the web-based ES&H “Drop-Box” and the Annual Safety Forums. The 2004 Safety Forum was held in January and focused on four key safety areas: Laboratory & Experimental Systems; Construction & Shop Safety; Risk Mitigation; and Electrical Safety. The Safety Forum outlined nearly 140 suggestions of which 32 came from the Electrical Safety breakout group. These suggestions and recommendations have been factored into our work plans.

Improving the Physical Condition

The OSHA inspection performed in August 2003 resulted in the identification of thirty-seven (37) electrical deficiencies. This inspection uncovered deficiencies that included the following types of issues:

- use of temporary wiring instead of permanent wiring
- clear marking of electrical components (e.g., circuit breakers) to allow their purpose to be readily determined
- providing protective coverings for light bulbs that may be at increased risk for breakage
- water leaks near electrical equipment
- installing on/off switches on certain machine tools
- grounding of lighting fixtures
- damaged insulation on power cords
- circuits needing GFCI protection
- need for NEMA class electrical components

At this time, twenty-eight (28) of the electrical safety items have been corrected. The remaining nine (9) are scheduled for completion this calendar year. We found the OSHA inspection to be valuable and we have been emulating their inspection techniques as much as possible in order to prevent OSHA deficiencies from arising as well as to identify/correct them quickly when they do arise.

Routine building walkthrough inspections are performed for all PPPL facilities on a prescribed frequency. Deficiencies identified during these inspections (including electrical infrastructure findings) are documented, assigned, and tracked to closure.

As part of the development of the Infrastructure “Ten-Year Site Plan” (TYSP), PPPL is currently performing a condition assessment of selected facilities as well as re-evaluating deferred maintenance. As part of this effort, we have identified the condition of the electrical infrastructure as a priority item within our planning consideration. Several of the buildings at PPPL are now 45 years old, and the electrical service within portions of these buildings typically do not match the needs of a modern research facility. The improvement of electrical service will be a major theme in the PPPL TYSP. This

will be a substantial undertaking that will span several years. The initiation of a General Plant Project will begin this endeavor in FY05.

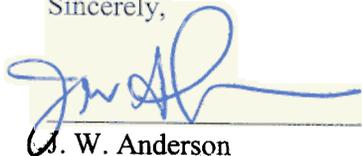
Action Plan

Following is a list that outlines several significant initiatives that are currently underway or planned for the upcoming fiscal year that relate to improving our electrical safety program. In some cases, the actions cited are broader than just electrical safety because we believe they play an important role in the behavior and performance of our work force.

1. Administer Graduate Student ES&H Training course (August 2004)
2. Cafeteria Electrical System Improvements (September 2004)
3. Hazard Awareness Training courses (ongoing throughout FY04/05)
4. Completion of OSHA inspection electrical deficiencies (December 2004)
5. PPPL Annual Site-wide Safety Forum (January 2005)
6. Initiate General Plant Project to upgrade aging electrical system infrastructure in older (e.g., >40 year old) buildings (FY05).

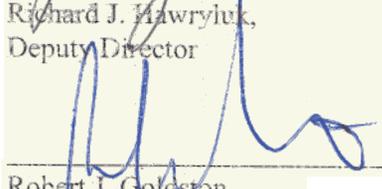
In conclusion, we share in the interest of the Department of Energy to continually strive to improve our programs and our performance. This letter merely serves as a summary of our electrical safety activities that help to provide a safe and productive workplace for our staff, collaborators and visitors. Please contact us if there are any questions or comments.

Sincerely,



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Head, ES&H and Infrastructure Support
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Concur:


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