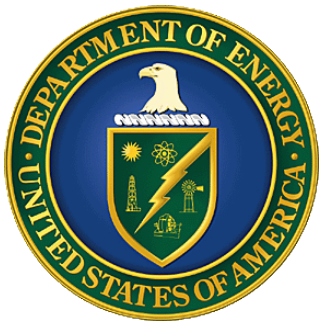

U.S. Department of Energy

Office of Inspector General

Office of Audits and Inspections

INSPECTION REPORT

Review of Electrical Safety at Selected Department of Energy Sites

OAI-L-16-08

March 2016

Department of Energy
Washington, DC 20585

March 24, 2016

MEMORANDUM FOR THE MANAGER, BROOKHAVEN SITE OFFICE
MANAGER, SAVANNAH RIVER SITE

FROM: April G. Stephenson
Assistant Inspector General
for Audits and Inspections
Office of Inspector General

SUBJECT: INFORMATION: Inspection Report on the "Review of Electrical Safety at Selected Department of Energy Sites"

BACKGROUND

Worker safety is of utmost importance in the Department of Energy (Department). However, the aging Department infrastructure provides challenges and potential hazards to its employees. One of these challenges is protecting workers who may be exposed to electrical hazards that could result in electric shock, electrocution, burns, fires, and explosions. In February 2006, Title 10 Code of Federal Regulations (CFR) § 851, *Worker Safety and Health Program*, established the framework for safe and healthful workplaces in which hazards are abated, controlled, or otherwise mitigated.

We reviewed controls over soil excavations and wall, ceiling, or floor penetrations where electrical conduits were possibly present because of their critical importance to worker safety. We also reviewed the use of lockout and tagout activities that employed physical barriers or warning devices to prevent the unexpected energization of equipment. We initiated this inspection to determine if Brookhaven National Laboratory (BNL) and the Savannah River Site (SRS) have effectively established and implemented electrical safety procedures for excavations, penetrations, and lockout and tagout activities to ensure a safe workplace.

RESULTS OF INSPECTION

Our inspection revealed that there were opportunities for improvement to decrease the risk of harm to personnel and infrastructure at BNL and SRS. While we did not discover any material issues, we identified isolated events where excavation and penetration workers had struck electrical conduits at SRS and BNL. Furthermore, we found tagout training and drawing review concerns at both sites. In addition, we identified issues with annual inspections that are completed to ensure that the lockout and tagout procedures are being followed at BNL. However, BNL and SRS have taken or initiated corrective actions to address these concerns.

Excavation and Penetration

BNL and SRS have experienced excavation or penetration incidents caused by factors such as employees not following established procedures and confusing work order documentation, as well as the limitations of the equipment used to identify electrical conduits. Even though these events appeared to be isolated events, BNL and SRS had taken corrective actions prior to our review and, Parsons Corporation (Parsons), which was the contractor involved in one of the incidents, took corrective actions as a result of our review to improve and implement policies and procedures.

During an April 2015 SRS excavation incident, Parsons struck a low-voltage electrical line at the Salt Waste Processing Facility. Officials informed us that the excavation commenced prior to completing the required pre-planning phase,[1] which includes a review of available site drawings and completion of ground penetrating radar (GPR) to identify any underground utilities and other interferences that may be present. According to CFR 1926, *Safety and Health Regulations for Construction*, which is required by CFR 851, the location of utility installations (such as sewer, telephone, fuel, electric, water lines, or any other underground installations) that workers may reasonably expect to encounter during excavation work should be determined prior to excavation. While this incident did not result in serious injuries due to the line's low voltage, it was concerning that crucial safety measures related to the excavation process were not effectively implemented. Furthermore, we found that the low-voltage electrical line that was struck during the excavation resided just above a decontaminated salt-solution line for transferring slightly radioactive material. We were informed that this was a non-operational line at the time of the incident; however, the breakdown of controls governing the excavation process increased the risk of an adverse future event occurring.

We were told that in this incident the contractor did not execute its mandated pre-planning phase due to miscommunication and confusion between night and day shift personnel. Specifically, the night shift did not indicate to the day shift that it had marked the area, and the day shift supervisor failed to confirm that the pre-planning phase had been completed prior to approving the excavation. The supervisor indicated that he assumed the survey team had completed the spray markings and that he had the survey results in his paperwork. The supervisor further indicated that he may have read from the wrong excavation permit due to the permits being bundled together at that time. The miscommunication and confusion led to striking an underground low-voltage wire.

As stated, prior to the incident, excavation permits were bundled together with other excavation permits making it difficult to review and sign off on specific permits within the work package. Parsons quickly discussed the event with the workers involved in the incident. During this discussion, Parsons' management counseled the personnel involved and reminded them of the pre-planning phase requirements that are to occur prior to the excavation. Also, as a result of our

[1] The pre-planning phase commonly involves a review of site drawings (either facility controlled or as-built drawings), and a scan to detect the location of underground/embedded utilities in subsurface materials, commonly known as Ground Penetrating Radar. Furthermore, a review of site drawings has been recognized within the Department's Electrical Safety Handbook as the most effective utility identification method. Lastly, the results of the pre-planning phase should be conveyed to workers through a pre-job briefing before work commences.

review, Parsons took corrective action to require that excavation permits be kept separate and tracked outside of the work package. This action allows supervisors and workers to better track the progress of the pre-planning phase that is listed on the excavation permits.

At BNL, we were informed of three penetration incidents that occurred prior to our review, two in November 2013 and one in January 2014, where workers inadvertently came into contact with electrical conduits during penetrations performed at the site. Following these incidents, the site's Assistant Laboratory Director for Environmental, Safety, and Health, issued a temporary halt to penetration permits until an investigation was performed and interim procedures were established. According to site officials, the incidents were due to the inherent limitations of the technology used to locate electrical conduits. During our review, GPR personnel informed us that, after the incidents, tests were performed on the site's GPR equipment where anomalies were noted. Specifically, personnel compared old GPR equipment previously used at the BNL site to new equipment used when performing the scans involved in the previously noted incidents. The results revealed that the new GPR equipment was providing a false reading when compared to the old equipment. The equipment was sent to the manufacturer and later returned to BNL in acceptable operating condition. BNL performed extensive updates to their policies and procedures for penetrations. Specifically, prior to our review, BNL had revised their procedures to require that a project lead visit a penetration site and evaluate whether the surveyed condition warranted additional or alternative actions.

The corrective actions taken appear to directly address the weaknesses associated with the specific incidents. Moreover, our review did not identify any subsequent reportable incidents similar to the ones identified in this report. We believe that these actions further enhance the policies and procedures that are already in place to decrease the risks to personnel and infrastructure.

Lockout and Tagout

BNL and SRS had developed lockout and tagout procedures. However, our review identified opportunities to improve tagout training, the conduct of annual lockout program inspections that are completed to ensure the lockout and tagout procedures are being followed, and the review and update of drawings prior to lockout and tagout procedures.

BNL and SRS provided training to their employees on the requirements for the lockout and tagout programs; however, improvements were needed in tagout training. In addition to lockout training, when tagout operations alone are employed, specific tagout training must be provided to ensure that employees understand the purpose and function of the tagout program. Four of the six tagout training requirements included in CFR 1910, *Occupational Safety & Health Administration,* under *Subpart J – General Environmental Controls, 1910.147, The control of hazardous energy (lockout/tagout),* were not included in BNL and SRS training. Specifically, training is to be provided on the requirements, which state: (1) tags must be legible and understandable by all authorized employees, affected employees, and all other employees whose work operations are or may be in the area, in order to be effective; (2) tags and their means of attachment must be made of materials that will withstand the environmental conditions encountered in the workplace; (3) tags may evoke a false sense of security, and their meaning

needs to be understood as part of the overall energy control program; and (4) tags must be securely attached to energy isolating devices so that they cannot be inadvertently or accidentally detached during use. Department and contractor officials at BNL indicated they were not aware of the specific requirements to include the missing tagout training information and SRS contractor officials were aware of the requirements but did not fully incorporate all of them into the training program. Prior to the completion of our review, both BNL and SRS had completed updates to the General Employee Training, which included the missing CFR requirements.

Although BNL had established an annual lockout and tagout inspection program, we noted that not all affected employees were part of the inspections. According to CFR 1910.147, affected employees include employees authorized to install locks and tags on equipment and machinery, as well as employees who perform service or maintenance on this equipment or who work in the tagout area. BNL employed a tagout only program and its procedures required the annual inspection to include all of the affected employees but, in effect, only employees who installed the locks and tags were included; those who operated the equipment or are required to work in the area where a tagout was in place were not included. As previously noted for the tagout training issue, BNL officials were also not aware of this annual inspection requirement. A BNL official stated that a plan had been implemented to ensure that all impacted BNL employees would receive the required training annually, and the training would be completed by September 30, 2016.

Finally, our inspection revealed that lockout and tagout operations did not always include a review of drawings to locate energy sources, and drawings were not always updated. The National Fire Protection Association requirements, found in BNL and SRS contracts, require that updated single-line drawings be the primary reference to locate energy sources. Although the majority of the lockout and tagout documentation we reviewed included drawings, we identified the following exceptions:

- Two BNL lockout operations did not include a review of drawings.

- One SRS drawing of a lockout and tagout operation identified that the circuit had been de-energized. However, employees found that the power had not been turned off.

We found that Department and contractor officials at both sites were aware of the issues concerning the drawings. We determined that both sites had taken actions to mitigate out-of-date and missing drawings by prioritizing and updating or creating drawings, as funding allowed.

SUGGESTED ACTIONS

Inadvertent striking of underground utilities could result in electrical shock, injuries, explosions, utility outages, operational interruptions, and death. While sites were aware of the inherent risks, without proper communication, appropriate and consistent training, annual inspections, and drawing reviews and updates, employees may be potentially placed at risk. Because of the efforts both sites had taken to improve controls during our inspection, we are not making recommendations, but we suggest that efforts to improve controls be an ongoing priority.

We appreciate the cooperation of your staff during our inspection.

Attachment

cc: Deputy Secretary
Chief of Staff
General Counsel

OBJECTIVE, SCOPE, AND METHODOLOGY

OBJECTIVE

We initiated our inspection to determine if Brookhaven National Laboratory (BNL) and the Savannah River Site (SRS) have established and implemented electrical safety procedures for excavations, penetrations, and lockout and tagout activities to ensure a safe workplace.

SCOPE

We conducted our inspection from April 2015 through March 2016 at BNL and SRS. We focused the inspection on procedures, processes, training, drawings, and surveys related to electrical safety for fiscal years 2009 through 2015. This inspection was conducted under Office of Inspector General project number S15IS010.

METHODOLOGY

To accomplish our objective, we:

- Evaluated Department of Energy (Department) and local policies, procedures, and guidance;
- Interviewed Federal and contractor officials, including site directors and employees responsible for excavation, penetration, and lockout and tagout activities;
- Toured available excavation, penetration, and lockout and tagout activities at BNL and SRS; and
- Reviewed and analyzed Occurrence Reporting and Processing System Reports for BNL and SRS.

We conducted this performance inspection in accordance with the "Council of the Inspectors General on Integrity and Efficiency Quality Standards for Inspections." Those standards require that we plan and perform the inspection to obtain sufficient, appropriate evidence to provide a reasonable basis for our findings and conclusions based on our inspection objective. We believe that the evidence obtained provides a reasonable basis for our findings and conclusions based on our inspection objective. Accordingly, we assessed internal controls and the Department's implementation of the *GPRA Modernization Act of 2010,* and determined that it had generally established performance measures related to the management of electrical safety. Because our review was limited, it would not necessarily have disclosed all internal control deficiencies that may have existed at the time of our inspection. Finally, we did not rely on computer-processed data to satisfy our objective.

An exit conference was waived by Office of Science management on February 23, 2016, and by BNL management on March 1, 2016. An exit conference was held with SRS and Office of Environmental Management on March 8, 2016.

FEEDBACK

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