Office of Environment, Safety and Health • U.S. Department of Energy • Washington, DC 20585

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

Summary 2002-04
February 25, 2002

The Environment, Safety and Health (EH) Office of Performance Assessment and Analysis publishes the Operating Experience Summary to promote safety throughout the Department of Energy (DOE) complex by encouraging the exchange of lessons-learned information among DOE facilities.

To issue the Summary in a timely manner, EH relies on preliminary information such as daily operations reports, notification reports, and, time permitting, conversations with cognizant facility or DOE field office staff. If you have additional pertinent information or identify inaccurate statements in the Summary, please bring this to the attention of Frank Russo, 301-903-1845, or Internet address Frank.Russo@eh.doe.gov, so we may issue a correction.

The OE Summary can be used as a DOE-wide information source as described in Section 5.1.2, DOE-STD-7501-99, *The DOE Corporate Lessons Learned Program*. Readers are cautioned that review of the Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

Operating Experience Summary 2002-04

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EVENTS

1. BACKHOE SEVERS BURIED ELECTRICAL POWER CABLE

On February 12, 2002, at the construction site for the Spallation Neutron Source (SNS) at the Oak Ridge National Laboratory, a backhoe operator struck and severed a buried 240-volt temporary power cable with his backhoe bucket. This tripped a circuit breaker and the operator was not injured. The contractor reported this as a near miss. (ORPS Report ORO--ORNL-X10SNS-2002-0001)

The buried cable supplied electrical power for the construction of the SNS Front End Building, and was included in surveys for buried electrical lines. This temporary power line was noted in the original excavation permit, and was marked at the construction site for information. However, since the cable lay outside the area being excavated, no particular care was taken to preserve its markings, and the markings were substantially obliterated during the excavation. As the excavation progressed, the height of the earthen mound forming around the excavation became a safety concern, and the excavation crew decided to slope the wall. This sloping activity entailed digging beyond the area originally planned, and into the location where the temporary power line was buried.

The investigation of this occurrence is still ongoing, and there are no formal causal analyses or lessons learned at this time. However, it appears clear at this point that the excavation permit should have been amended to address the new area being dug. If done correctly, the amendment process would have identified the buried electrical line from the previous surveys.

On January 30, 2002, a similar event involving a backhoe severing a 480-volt buried line occurred near Buildings 52 and 58 at the Thomas Jefferson National Accelerator Facility. The site utility drawing incorrectly indicated that there were no electrical lines in the vicinity. (ORPS Report ORO--SURA-TJNAF-2002-0001) On February 18, 2002, a contractor cut through a 110-volt conduit with his concrete-cutting saw while installing a shower drain line at the Argonne National Laboratory. As-built drawings were inaccurate, and there had been no instrument surveys for embedded conduits. (ORPS Report CH-AA-ANLE-ANLEPES-2002-0002) There were no injuries in either occurrence.

The Office of Performance Assessment and Analysis has issued a lessons learned on Electrical Intrusion Events through the Society for Effective Lessons Learned Sharing (SELLS). This document (Identifier: HQ-EH-2002-01) can be accessed from the SELLS database at http://tis.eh.doe.gov/ll/listdb.html.

The Office of Performance Assessment and Analysis is also requesting information from DOE and subcontractor offices on good practices in excavation and electrical penetration safety. The scope of electrical intrusion events includes accidental contact or penetration of underground utilities and embedded or hidden utilities within structures (i.e., walls, floors, and ceilings). These good practices should come from facility programs that have been successful in preventing penetration-type incidents. We intend to compile this information and share it throughout the DOE complex. Individuals or organizations wishing to respond to this request may contact Jim Snell, (301) 903-4094 or at Jim.Snell@eh.doe.gov.

KEYWORDS: *Underground cable, buried cable, excavation, electrical intrusion, near miss*

ISM CORE FUNCTION: *Perform Work Within Controls*

2. ELECTRICAN SHOCKED AFTER REPAIRING WELDING RECEPTACLE

On December 10, 2001, in Building 98 at the Thomas Jefferson National Accelerator Facility, a journeyman electrician received an electrical shock while connecting the ground lead from a welding

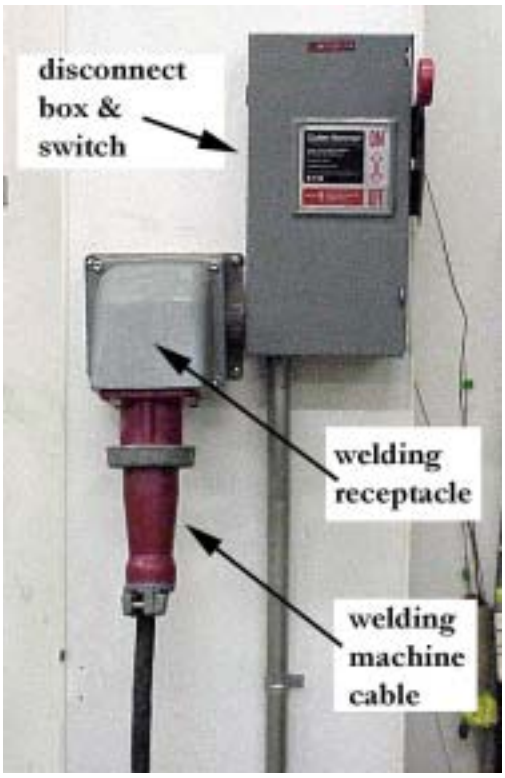

Figure 1: 480-volt disconnect box and welding receptacle

machine to a worktable. He had twice repaired a receptacle that supplied electricity for welding and he was testing a welding machine after the second repair. Immediately after the shock, the electrician was examined at the laboratory's clinic and later by an outside physician. He was given a prescription pain reliever. He suffered no permanent physiological injury; however, because of his injury, he was placed on medical work restriction for 19 days. (ORPS Report ORO--SURA-TJNAF-2001-0005, Final Report 2/6/02)

During the morning of December 10, 2001, a loud bang was heard from a 480-volt disconnect box in Building 98 (see Figure 1). At the same time, a feeder panel breaker tripped, causing a loss of electrical power. A journeyman electrician locked out the box and checked the circuit. He found that a wire in the welding receptacle attached to the disconnect box had chafed and shorted out. The electrician replaced this single wire, along with a fuse in the disconnect box. A laboratory electrical coordinator reset the feeder panel supplying power to the building, and two other electricians checked the building's 480-volt circuit. They found no problems.

When the welding activity resumed an hour and a half later, the disconnect box produced another loud bang, and power was lost. The electrician again locked out and checked the box and welding receptacle. This time, he found that the ground wire in the receptacle had melted and damaged another wire it touched. He replaced the two wires (see Figure 2). When his supervisor questioned him about his first repair, the electrician stated that he may have overlooked other wires in the receptacle that may also have been chafed. Suspecting that the first welding machine might be faulty, the supervisor replaced it with a second machine of different manufacture, which seemed to operate correctly.

In the afternoon, after the first welding machine was checked for obvious problems such as burnt wires and circuit boards, the electrician plugged it back into the welding receptacle with its power switch turned off. As he was connecting its spring-loaded ground lead to a worktable, the electrician received a shock. His coworkers took him for medical attention.

The electrician's supervisor instructed other employees to lock out and check the disconnect box and welding receptacle. They found no problems, and so the supervisor again suspected that the first welding machine was faulty. He had the second welding machine reconnected and tested, and again it appeared to work properly. However, as a welder was moving the second machine at the end of his shift, he noticed an electrical arc between the foot pedal's metal housing and a metal table leg as he pulled the machine's cable across the floor. The supervisor and facility manager

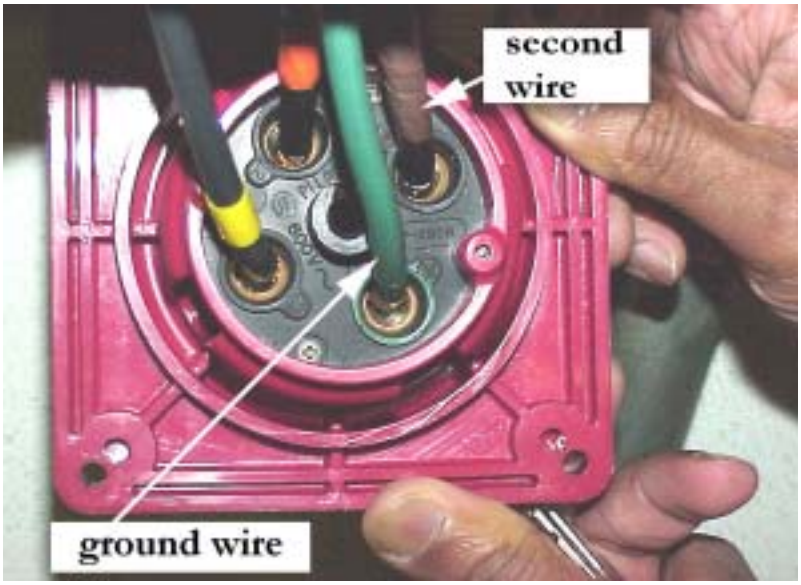

Figure 2: Welding receptacle wires correctly connected

believed that the 480-volt distribution system might have become damaged, and ordered that all welding receptacles be tagged out.

The next day, the plant engineering staff and electricians checked the 480-volt distribution system for grounding and other problems, but could not immediately find any. Finally, the plant engineering staff found that the welding receptacle's green ground wire was not in the green-ringed ground pin as would be appropriate (see Figure 2 for correct wiring configuration). The staff concluded that the electrician must have switched the ground wire with a hot phase wire during his second repair of the receptacle. Although he made some voltage verification checks, he obviously failed to make all the required checks.

The Laboratory Director ordered a laboratory-wide stand-down of all welding activities on December 14, 2001, in response to this occurrence and other recent events involving improper bonding and grounding of welding machines. Corrective actions included:

- performing testing and certification of all welding receptacles
- conducting briefings for welders and electrical safety personnel
- performing annual inspections of welding machines
- adopting new procedure requirements for grounding in welding areas
- partnering the journeyman electrician with senior electricians while performing electrical activities

A search of the ORPS database found two other recent discoveries of incorrectly wired electrical receptacles. On January 27, 2002, computer workers found a 208-volt receptacle incorrectly wired in Building 201 of Argonne National Laboratory – East. (ORPS Report CH-AA-ANLE-ANLEPFS-2002-0001) On December 13, 2000, electricians found that a 120-volt outlet on a rental manlift was incorrectly wired at Hanford's Waste Receiving and Processing Facility. (ORPS Report RL--PHMC-WRAP-2000-0005) No one was shocked in these occurrences, but the contractors felt they were a near miss or potential concern.

The causal analysis for the occurrence at the Thomas Jefferson National Accelerator Facility cited the electrician's lack of electrical safety awareness and inattention to detail as the root causes. Had the electrician adequately verified his work, he would have found the receptacle's incorrect wiring. This occurrence also illustrates that troubleshooting electrical circuit problems can be complex and difficult. Unsolved troubleshooting and false conclusions can lead to injury.

KEYWORDS: *Welding machine, disconnect box, welding receptacle, grounding*

ISM CORE FUNCTION: *Perform Work Within Controls*

3. BREACH OF RADIOLOGICAL AREA BOUNDARY RESULTS IN A NEAR MISS

On November 15, 2001, at the Nevada Test Site, two Bechtel Nevada (BN) construction carpenters breached a posted radiological boundary for hot cells located in Area 25. The carpenters were installing Plexiglas® windows in the boundary, which consisted of plywood sheets that had replaced the original lead-glass windows in the 4-foot-thick concrete walls of the hot cells. The carpenters failed to comply with the radiological postings on the boundary and did not have radiological control technician coverage. No detectable radioactive contamination was found with portable instruments or swipes on personnel, equipment, plywood, surfaces inside the window opening, or on the floor. However, because of the potential for personnel contamination, the facility manager reported this occurrence as a near miss. (ORPS Report NVOO--BN-NTS-2001-0018; Final Report filed February 11, 2002)

This work was being performed in support of ongoing deactivation and decommissioning at Area 25. The plywood coverings on the windows were posted with "Internal Contamination" tape and covered with a metal RADCON "Caution Contamination Areas Inside" sign by previous contractors. The center of the plywood covering was to be replaced with a clear piece of Plexiglas® so that, following the planned modification of the pieces of plywood establishing the inside of the window openings, workers could be observed performing decontamination activities. A BN radiological control technician discovered the carpenters working at the window area and stopped work, secured the area, and conducted radiological surveys.

A critique of this occurrence was conducted to determine the causal factors. Critique members identified the direct and root causes as personnel error (inattention to detail).

- The carpenters failed to follow their Radiological Worker II training by not complying with the postings at radiological barriers.
- The carpenters did not suspend or stop work when they encountered the posting, and proceeded to cut the plywood window coverings without proper radiological control technician coverage.
- The BN construction site superintendent failed to use the correct work package, and directed work to be accomplished that was outside of the work package scope.
- The BN construction site superintendent did not recognize during work planning that some of the tasks consisted of radiological work, and so did not comply with the requirements of the Nevada/Yucca Mountain Project Radiological Control Manual.

Inadequate Administrative Control was identified as a contributing cause to this occurrence.

- The project team did not have a formalized process to add or approve work that was not in the approved Plan of the Day.
- The work being performed by the carpenters as directed by the BN construction site superintendent, was outside of the identified and approved work package because an inappropriate non-radiological work package was mistakenly used to direct the work.

The following are some corrective actions that have been implemented as a result of this event.

- The Environmental Restoration Project Manager issued a work authorization memorandum detailing roles, responsibilities, and approval authority for work activities.
- Environmental Restoration Project and BN construction management developed a formal mechanism for revising and changing work control packages in their organization's work process operating instructions and directives.
- The BN Health Physics Department Manager and BN Safety & Industrial Hygiene Manager reviewed all existing work packages and will review future work packages.

A similar occurrence was reported on June 28, 2001, in which a BN employee was observed walking in a posted radioactive contamination area without the proper protective equipment. (ORPS Report NVOO--BN-NTS-2001-0008) The employee failed to adhere to the recently revised posting requirements. The posting had been upgraded from a radioactive materials area to a radioactive contamination area at the start of that day's shift, but the employee did not enter the area through the established entry point and did not receive a tailgate briefing prior to entry into the work area and instead relied on past practice rather than checking the current posting. As a result of the incident, the Project Manager conducted a project safety stand-down to discuss postings, barriers, access points, and site-specific briefings. The BN Price-Anderson Amendments Act (PAAA) Senior Review Board met on January 3, 2002 and reviewed PAAA Concern No. 2001-0009, "Breach of Radiation Area Boundary." On January 18, 2002, the incident was entered into the Noncompliance Tracking System under number NTS-NVOO-BNOO-NTS-2002-0001.

This incident underscores the importance of conducting pre-job briefings in which the conditions and processes of the work are properly communicated to all of the involved workers. The scope of work,

definitions, and limitations in work authorization documents must be completely understood by the workers before they begin work.

KEYWORDS: *Contamination, radiological, breach of radiological boundary, hot cell*

ISM CORE FUNCTION: *Perform Work Within Controls*

4. TRAPPED STEAM EXPELS VALVE PACKING DURING TROUBLESHOOTING

On December 12, 2001, at the Rocky Flats Environmental Technology Site, steam and valve packing were expelled from a steam control valve in the 374 Operations facility when a mechanic accidentally removed the packing gland and follower. The mechanic should have removed the valve actuator, but removed the wrong fasteners because of inadequate instructions in the repair work package. The valve, which is exposed to steam at 100 pounds per square inch, had been isolated, but the pressure between the isolation points was not released, thereby keeping the valve internals pressurized. The job was stopped, and personnel left the area until the valve was locked and tagged out. There were no personnel injuries or equipment damage as a result of this event. (ORPS Report RFO--KHLL-374OPS-2001-0004; Final Report filed January 28, 2002)

A troubleshooting and repair standard work package was being used to remove a valve actuator (illustrated in Figure 1). The planning team walked the job down several times, but did not discuss the specific work steps to be performed. The resulting work package failed to include adequate direction to perform the planned work. In addition, a subsequent review of the technical documentation on the valve found that the work package did not direct the correct sequence of troubleshooting steps. Also, the technical manual for the valve was not available on site. Because of the deficiencies in the work package, the work instructions did not provide specifics of the steam valve assembly or detailed instructions to remove the actuator from the valve.

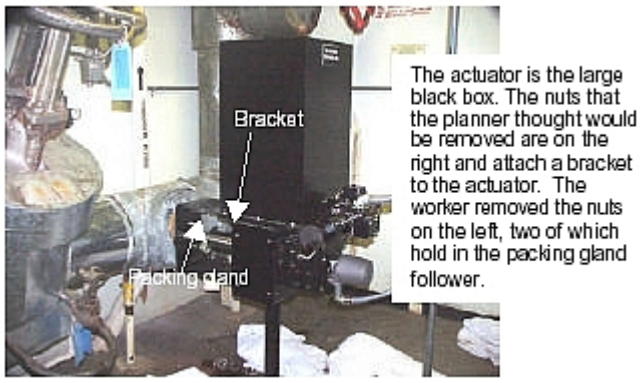

Figure 1. The valve actuator

A good practice was noted when the operators isolated the control valve and opened a drain valve to depressurize that portion of the system. This isolation was not required by the work package. The planner had assumed that the actuator could be accessed by removing the nuts that were closest to the actuator on the right side for the mounting bracket. The mechanic removed two nuts on the left on the valve body, which held the packing gland follower in place (shown in Figure 2). These two nuts are components of the pressure boundary. The mechanic stated that he felt comfortable removing the packing gland nuts because he knew that the system had been isolated and the drain valve had been opened.

The supervisor had asked if the system was to be breached during the work and was told by engineering that it was not, but the supervisor was not familiar with the proper way to remove the actuator and not knowledgeable with the planned work to determine if it could be performed safely. Although the inlet valve and outlet valve for the steam control valve were closed and the drain valve was open, no one identified the potential for trapped residual steam pressure and the need for venting. The residual steam in the system caused the packing gland components to be unexpectedly expelled.

Figure 2. The packing gland

The direct cause of this occurrence was inattention to detail. The mechanic was unable to determine which nuts needed to be removed in order to de-couple the actuator because the description and instructions in the work package were inadequate for the work to be performed. The root cause was inadequate work planning, which resulted in a loss of work control. The work instructions did not contain sufficient detail about the steam valve assembly to remove the valve actuator. In addition, a lockout/tagout should have been applied to the valve in any event.

This occurrence illustrates the importance of comprehensive work planning and clear communication between all personnel involved in the work process. Work planners and job supervisors need to have a clear understanding of the equipment and work to be performed, or they should include subject matter experts in the work planning process. Work instructions need to clear and of sufficient content to correctly complete the task. In this occurrence the planner assumed that the mechanic knew how to accomplish the task without compromising the pressure boundary. Workers are ultimately responsible to comply with all applicable safety rules to ensure personal safety while performing assigned duties. Workers should continually question work practices, and when unsure of the work being performed, they should immediately stop and contact their supervisor. It is imperative that when questions arise concerning the work, every attempt should be made to expeditiously answer those questions to prevent any misunderstanding of the work that is being performed.

Rocky Flats issued a Site Safety Bulletin to distribute information on this event throughout the site. They also shared this bulletin with the Office of Performance Assessment and Analysis for the preparation of these lessons learned.

KEYWORDS: *Steam, work planning, pressurized, valve*

ISM CORE FUNCTION: *Define the Scope of Work, Develop and Implement Hazard Controls*

5. NEAR MISS FROM COMPRESSOR MOVED BY OVERHEAD CRANE

On December 13, 2001, in the K-33 Building at the East Tennessee Technology Park, a heavy compressor being moved by an overhead crane nearly struck a radiological safety technician. The technician had been surveying respirators in storage cabinets along the crane bay near the path of the suspended compressor. As he closed a cabinet door, he noticed the compressor was moving near him. He moved inside a cabinet to avoid the moving load, but a compressor nozzle caught the cabinet's door and started to tip it over. The technician was forced to dive under the compressor to escape injury. The contractor reported this occurrence as a near miss. (ORPS Report ORO--BNFL-K33-2001-0025)

The crane operator was on the floor and was using a remote control to move an 18-ton axial compressor, suspended three and half feet above the floor. The compressor was 10 feet wide. The crane bay he moved it through had storage cabinets on both sides, forming an aisle 14 feet wide. As required, there were spotters in front of and behind the compressor, but neither saw the technician. The front spotter was watching for traffic in a cross-aisle ahead of the crane bay. The crane operator had seen the technician working by the cabinets and should have stopped the crane, but did not. The technician earlier saw the suspended compressor moving and should have left the area, but did not.

The causal analysis for this occurrence noted that both the crane operator and technician violated facility procedures by their non-actions. Had the crane been stopped, or had the technician moved, the near miss could have been avoided. The causal analysis also noted that the cabinets should have been placed in a less active area. The cabinets stored powered air purifying respirators (PAPRs) and had been relocated in the crane bay temporarily to accommodate construction in another area.

One corrective action consisted of moving the PAPR storage cabinets away from the crane bay. Others involved issuing safety notes highlighting the following requirements:

- Work planners need to inspect active work areas for cabinets, tool boxes, and common-use items and remove these before work begins;
- Crane operators must stop moving loads when workers are in the vicinity; and
- Workers are to leave areas where heavy loads are moving.

Most recent ORPS reports involving cranes concern dropped loads or rigging problems. However, there was a similar occurrence on September 20, 2001 at the Lawrence Livermore National Laboratory, in which a moving overhead crane nearly hit a worker. The worker was accessing the roof of the building with a ladder. The crane broke the worker's ladder; however, the worker escaped injury by lying prone while the crane passed over him. In this case, the operator and spotters at floor level could not see the worker above them. (ORPS Report OAK--LLNL-LLNL-2001-0038, OE Summary 2001-07)

The crane occurrence in the K-33 Building illustrates that violating procedures could lead to harm, and that equipment temporarily relocated in active work areas can lead to unsafe conditions.

KEYWORDS: *Storage cabinet, overhead crane, and near miss*

ISM CORE FUNCTIONS: *Analyze the Hazards, Perform Work Within Controls*