OPERATING EXPERIENCE SUMMARY

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The Office of Environment, Safety and Health, Office of Corporate Performance Assessment publishes the Operating Experience Summary to promote safety throughout the Department of Energy 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 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, 301-903-8008, or Internet address Frank.Russo@eh.doe.gov, so we may issue a correction. If you have difficulty accessing the Summary on the Web (URL http://www.eh.doe.gov/paa), please contact the ES&H Information Center, (800) 473-4375, for assistance. We would like to hear from you regarding how we can make our products better and more useful. Please forward any comments to Frank.Russo@eh.doe.gov.

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EH PUBLISHES "JUST-IN-TIME" REPORTS

The Office of Environment, Safety and Health recently began publishing a series of "Just-In-Time" reports. These two-page reports inform work planners and workers about specific safety issues related to work they are about to perform. The format of the Just-In-Time reports was adapted from the highly successful format used by the Institute of Nuclear Power Operations (INPO). Each report presents brief examples of problems and mistakes actually encountered in reported cases,then presents points to consider to help avoid such pitfalls.

The first six Just-in-Time reports were prepared as part of the 2004 Electrical Safety Campaign.

1. Deficiencies in identification and control of electrical hazards during excavation have resulted in hazardous working conditions.
2. Deficiencies in work planning and hazards identification have resulted in electrical near misses when performing blind penetrations and core drilling.
3. Working near energized circuits has resulted in electrical near misses.
4. Deficiencies in control and identification of electrical hazards during facility demolition have resulted in hazardous working conditions.
5. Electrical wiring mistakes have resulted in electrical shocks and near misses.
6. Deficiencies in planning and use of spotters contributed to vehicles striking overhead power lines.

EH plans to issue more Just-in-Times soon on other safety issues, such as lockout and tagout, fall protection, and freeze protection. All of the Just-in-Times can be accessed at http://www.eh.doe.gov/paa/reports.html.

EVENTS

1. EXPECT THE UNEXPECTED DURING D&D WORK

On April 29, 2004, during demolition operations at the Mound Plant, an operator was cutting the roof to a breezeway (Figure 1-1) connected to a building annex when he noticed that the roof was moving. As the operator moved the excavator away from the breezeway, it collapsed, and part of the breezeway overhang struck the excavator cab. The windshield and cab frame of the excavator were damaged, and the operator sustained a minor first-aid injury to his left index finger. (ORPS Report OH-MB-BWO-BWO04-2004-0005)

Figure 1-1. The collapsed breezeway

Figure 1-2 shows the extent of the damage to the excavator. An investigation disclosed that the breezeway collapsed because the supporting base plates were not bolted in place when it was constructed in the 1950s (Figure 1-3), although the construction drawings indicated that they were. The excavator operator had helped demolish two other buildings and their breezeways, and in both of those cases the breezeway base plates were bolted down.

Facility management took the following corrective actions to preclude recurrence.

1. The structural engineer who previously reviewed the demolition plan re-evaluated his review.

Figure 1-2. Damage to the excavator

2. Project personnel issued a summary on the breezeway collapse that focused on the changed configuration of the breezeway.

3. Other buildings and demolition plans are being reviewed to identify unanchored supports.

4. Facility management is considering the use of longer-reach equipment for future demolition activities to maintain a safe distance for equipment and operators.

Figure 1-3. Unsecured base plate

This event illustrates the importance of verifying the configuration of legacy structures before proceeding with demolition. In the past, the configuration of facilities was often inconsistent and poorly documented. Demolition work planning should include a careful review to verify the structural configuration of buildings undergoing D&D and consider measures to protect personnel should the unexpected happen.

KEYWORDS: *Near miss, D&D, legacy configuration, excavator*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls*

Figure 2-1. Concrete on drill bit

2. NEAR MISS: BURIED 13.8-kV CABLE STRUCK BY DRILLING RIG BIT

On April 1, 2004, at the Kansas City Plant, workers using a drill rig to collect soil samples struck an energized 13.8-kV cable in an underground concrete duct bank, causing a power outage in some areas of the site. Workers reported no immediate visible or audible indication that the cable had been struck, although they later saw cable debris. Investigators found errors in the as-built drawings, identified deviations in the work planning process, and determined that a required utility locate scan was not performed. No injuries resulted from this occurrence, although there was the potential for serious injury. (ORPS Report ALO-KC-AS-KCP-2004-0013)

The drilling crew intended to collect soil samples to a depth of 50 feet. They had stopped drilling twice before this incident occurred: first at a depth of 2½ feet when they encountered gravel; then at 4¼ feet when they saw concrete coming off the drill bit (Figure 2-1). Because the concrete was neither marked nor color-coded, the crew resumed drilling, and once again stopped at 4½ feet, when the workers saw wire fragments and cable insulation coming out of the hole (Figure 2-2).

Investigators determined that procedures required performing a scan of the proposed drilling site to locate underground utilities and that the project manager had requested a scan 2 months before work began. However, the assigned utility engineer retired and left the site without performing the scan. When he received no information to the contrary, the project manager assumed the scan had been performed and no utilities were found in the area. Based on this assumption, the project manager persuaded a new utility engineer, who had replaced the retired worker, to sign off on the excavation permit. In addition, the project manager incorrectly told workers that the area had been scanned for utilities and KCP personnel were not contacted when workers noticed debris (i.e., gravel and concrete) coming off the drill bit.

Investigators determined that the causal factors for this incident included failure of the assigned utility engineer to perform the utility locate scan and failure of the project manager to validate performance of the scan. They also identified violations of the work planning procedure (e.g., signing the excavation permit on the day of the job) as a causal factor for the event.

Investigators also identified errors in the plant as-built drawings. The as-built drawings for the site showed that the 2-inch-thick concrete cable duct was located several yards from where it was struck. Site management initiated a program to review the technologies available to perform underground scans and to determine which will best meet site needs. When a technology has been selected, a decision will be made regarding whether to update the plant-wide, as-built drawings or to continue scanning on an as-needed basis.

Figure 2-2. Pieces of wire and cable insulation

Corrective actions being pursued as a result of this occurrence include the following.

- Conduct a stand-down with facility and maintenance engineers to address roles, responsibilities, and expectations with regard to the planning and conduct of work.

- Investigate the accuracy of plant as-built drawings and make corrections as appropriate.

- Identify the person authorized to initiate work with the contractor in applicable documentation.

- Modify the work-planning process description with built-in mistake-proofing to the extent possible.

- Establish a maximum time interval between the scan and work start.

- Require that the utility engineer have direct knowledge of the performance of the utility locate scan before signing the excavation permit.

- Clearly identify the investigatory hold points be imposed in excavation tasks whenever unexpected conditions are encountered.

- Clarify in appropriate documents the titles, functions of those who sign excavation permits, as well as what their signature on the permit signifies.

- Implement a ground-marking program for all buried utilities before excavation begins.

- Require that excavations be designated as a high-hazard activity to improve reviews and approvals.

A search of the ORPS database for other events involving interactions with high-voltage energy sources revealed several recent events. On September 2, 2003, at Los Alamos National Laboratory, demolition workers were preparing to remove a 13.2-kV switch cabinet that they were told was de-energized. Without using any personal protective equipment, an electrician performing a zero-energy check moved a proximity detector within 6 inches of the 13.2 kV switch, and the detector indicated the presence of voltage. (The National Electric Safety Code defines the minimum safe approach distance to 13.2-kV equipment as 2 feet.) No arc occurred and no injuries resulted from this incident, but the electrician who performed the zero-energy

GOOD PRACTICES FOR PREVENTING ELECTRICAL INTRUSION EVENTS AND RESULTING INJURIES

- Locate and clearly mark all electrical conductors in the ground or in ceilings, walls, and floors as part of the work planning process for excavation, D&D, or construction tasks.
- When there is any possibility of encountering energized electrical conductors, always wear/use electrically rated personal protective equipment.
- Perform surveys for unanticipated energy sources near the location of the work, and not just for “known” sources.
- Employ utility locator services or use the latest available technology that is appropriate for the task at hand.
- Standardize permit processes and methods for identification and location of buried or otherwise concealed utilities.
- Perform excavation or penetration work (in ceilings, walls, or floors) in a timely manner following the utility surveys and marking of locations.
- Exercise “stop work authority” if unanticipated conditions are encountered.

check was at great risk of serious injury. (ORPS Report ALO-LA-LANL-WASTEMGT-2003-0006)

Additional information on electrical safety occurrences can be found in two reports by the DOE EH Office of Corporate Performance Assessment, *Department of Energy Electrical Safety,* published in April 2004, and *A Review of Electrical Intrusion Events at the Department of Energy: 2000-2001,* dated June 2002.

These events underscore the importance of detailed job planning and effective work authorization and control practices when working with or near high-voltage electrical systems. The responsibility for ensuring adequate planning, authorization, and control of work activities rests with line management. Similarly, line managers need to ensure that safety requirements are followed at all times by all personnel.

KEYWORDS: *13.8-kV cable, high voltage, energized conductor, drill rig, utility locate survey, electrical intrusion, power outage*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls, Perform Work within Controls*

3. TAKE ACTION TO CHANGE SAFETY PERFORMANCE

On February 25, 2004, at a Sandia National Laboratory (SNL) construction project, a third-tier steel-erection subcontractor dropped a 1,000-pound bundle of steel decking material (Figure 3-1) to a concrete deck 20 feet below. No one was injured, but the material was slightly damaged, as was a wooden guardrail (Figure 3-2) and an unoccupied scissor lift. (ORPS Report ALO-KO-SNL-1000-2004-0001; final report filed March 4, 2004)

The accident occurred as the worker directing the lift tried to readjust the suspended load. He pushed too hard on the load, and the decking slid out of the rigging and fell to the ground. The worker re-rigged the material and lifted it to its intended place without notifying his supervisor of the dropped load. He also failed to notify either the SNL general construction contractor or SNL management.

When SNL management learned of the incident, they conducted a critique; the general contractor removed the worker from the site and issued a formal stop-work. The general contractor also held a safety meeting with about 80 workers to describe the event and emphasize the importance of proper rigging practices and the use of qualified riggers. The contractor also discussed previous safety-related events, as well as their "Zero Injuries" program, and stressed the importance of timely notification of events.

SNL management issued a formal stop-work order to the general contractor for steel-erection activities, citing this and previous safety deficiencies on the part of the third-tier subcontractor. SNL management identified the following requirements that had to be met by the subcontractor before work could resume on the project.

- Provide formal documentation of the qualification of all workers employed on this activity.
- Provide training or re-training to establish a full understanding of the administrative safety requirements on this project.
- Develop a plan for the oversight level of the subcontractor's safety work practice activities.
- Develop a plan to meet the accountability requirement of all supervision provided by the subcontractor during the remaining steel erection activities.

Figure 3-1. Dropped decking material

Figure 3-2. Shattered junction box cover

The general contractor issued a Safety Action Plan on March 3 that acknowledged the seriousness of the February 25 event. They sent a copy of SNL's stop-work order to the subcontractor with a letter that warned: "Failure to comply with this directive will be considered a cause for termination." The contractor acknowledged that they had previously attempted to change the subcontractor's approach to safety without success. They indicated that terminating the subcontractor's contract would make clear to everyone involved that safety is a top priority at the SNL construction project.

Before work resumed, the steel-erection subcontractor assigned additional foremen to the project and added an onsite safety manager to ensure adequate supervision of their work. They also placed renewed emphasis on holding subcontractors accountable for any questionable safety practices, using written warnings and, if necessary, termination.

Since work resumed on the project, SNL safety and health personnel report that both the general contractor and the subcontractor have greatly improved their safety consciousness and are continually looking for ways to make the jobsite safer.

Appendix D to 29 CFR 1926.64, *Sources of Further Information (Nonmandatory),* refers to a widely read report known as the Business Roundtable A-3 report, *Improving Construction Safety Performance.* This report includes criteria for evaluating and improving contractor safety performance. The Construction Users Roundtable has posted this document on their web site at http://www.curt.construction.com/pdf/135.pdf.

The Office of Environment, Safety and Health published a review of hoisting and rigging events that discusses safety performance from 2001 through 2003 and offers lessons learned and specific actions to prevent recurrence. This report can be accessed on the Internet at http://www.eh.doe.gov/paa/reports/HR_INPO_Style_FinalDraft_01-20-04.pdf.

The event at SNL demonstrates an effective method of changing workers' attitudes about safety performance. Subcontractor workers need to know that they will be held accountable for safety deficiencies before adverse events occur.

KEYWORDS: *Stop-work, construction, rigging, subcontractor, near miss, dropped load*

ISM CORE FUNCTIONS: *Perform Work within Controls, Provide Feedback and Improvement*

4. IMPROPERLY APPLIED FOAMING AGENT CAUSES EXCESSIVE HEAT BUILDUP

On February 12, 2004, at the Rocky Flats Environmental Technology Site, workers preparing to remove waste drums from an unoccupied building noticed an unusual odor, saw wisps of light-green smoke coming from conduit penetrations above an exterior door, and alerted the fire department. Firefighters were able to dissipate the smoke, but could not identify or eliminate its source because the room was sealed and inaccessible. Because there was evidence of combustion, the facility manager declared an emergency. No injuries or exposures to radiological or hazardous materials resulted from this event. (ORPS Report RFO--KHLL-D&DOPS-2004-0003; final report filed April 22, 2004)

When the event occurred, the building was nearly ready for demolition. Workers had applied an exothermic foaming agent, Autofroth® 9453, to fill underground voids and minimize future ground slumping. Autofroth is a polyurethane foam agent typically applied between two layers of known temperature, with a final thickness of less than a few inches. When applied at the right depth and allowed to cure correctly, there is no heat/exothermic reaction.

Autofroth had been used at the site as a cribbing/padding material in waste cargo containers (Figure 4-1) and as a filler for gloveboxes before disposing of them. In these high-volume applications, adjustments were made to the application process to dissipate the heat generated during the exothermic reaction, thus minimizing the potential for smoking and charring.

For large-volume applications, the manufacturer (BASF) recommends applying the foam so it expands to no more than 24 inches and curing it for at least 90 minutes before applying more foam. Investigators determined that workers applied the Autofroth to a broader area than the manufacturer recommended. They believe that the mass of Autofroth applied, in conjunction with its insulating properties, resulted in excessive heat buildup and the green smoke observed by workers.

Investigators determined that the application process itself was flawed and that incorrect mixing of the two components led to hot spots, and voids in the foam, which trapped oxygen and fed the fire. In addition, only two of the nine crew members were fully trained and qualified to perform foaming operations.

Figure 4-1. Autofroth in a waste cargo container

Investigators also determined that the manufacturer's recommendation for limiting the base depth and allowing curing time for heat dissipation had not been adequately incorporated into the work instructions. Work planning and performance apparently depended largely on subject matter expert knowledge. In addition, the work package did not comply with the Integrated Work Control Program process, and this was a contributing factor to the event.

Exothermic reactions from foaming agents have occurred at other sites undergoing D&D. In November 2003, at the Savannah River Site, a four-pack of tanks was undergoing two-stage D&D with application of an absorbent material (approximately 30 gallons of liquid was in the bottom of the tank), followed by a foaming agent. Workers foamed a tank with layers that did not exceed 1 inch and allowed time for cooling each layer as the tank was filled. The next day, however, workers observed smoke and an acidic vapor from the tank and evacuated the area. Chemists suspected that residual organics in the tank contributed to the vapor. (ORPS Report SR--WSRC-FDP-2003-0009)

In January 2003, at the Savannah River Site, workers saw smoke coming from a decontamination chamber filled with polyurethane foam that was located in a high contamination/high radiation area. In this case, the mix components had not reached the required temperature before mixing, and the resulting ratio was 2/1 instead of 1/1. The large area covered, incorrect application, and use of a large spray nozzle contributed to the exothermic reaction and large volume of smoke. (ORPS Report SR--WSRC-LTA-2003-0002)

Although accelerated closure presents management challenges that require unique or innovative solutions, those solutions must be carefully analyzed, planned, and implemented. Foaming as a bracing and stabilizing agent is just such an innovative technology that, when carefully used, can help accomplish mission work and closure. However, when used incorrectly without adequate training, such innovations can have adverse safety and schedule implications.

These events underscore the importance of training and qualification of all team members assigned to perform a job (not relying on a few experienced operators) and following manufacturer's instructions. It is important to check each step to ensure that the step has been performed correctly and that all conditions, such as correctly timing each step, have been met.

Keywords*: Exothermic, smoke, foam, Autofroth, D&D*

ISM Core Functions*: Analyze the Hazards, Perform Work within Controls*

Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
DOE	Department of Energy
DOT	Department of Transportation
EPA	Environmental Protection Agency
INPO	Institute for Nuclear Power Operations
NIOSH	National Institute for Occupational Safety and Health
NNSA	National Nuclear Security Administration
NRC	Nuclear Regulatory Commission
OSHA	Occupational Safety and Health Administration
SELLS	Society for Effective Lessons Learned

Units of Measure	
AC	alternating current
DC	direct current
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
NOV	Notice of Violation
SAR	Safety Analysis Report
TSR	Technical Safety Requirement
USQ	Unreviewed Safety Question

Regulations/Acts	
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
RCRA	Resource Conservation and Recovery Act
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement

Miscellaneous	
ALARA	As low as reasonably achievable
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control