OPERATING EXPERIENCE SUMMARY

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The Office of 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 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.

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EVENTS

1. TEMPORARY WINDOW COVER FALLS TO FLOOR

On September 16, 2002, at the Stanford Linear Accelerator Center (SLAC), a 3½-foot by 6-foot by 1/8-inch sheet of Masonite® covering a window fell 20 feet to the floor and landed less than 1 foot from a SLAC employee. No injuries resulted from this near-miss event. (ORPS Report OAK--SU-SLAC-2002-0010; final report filed October 22, 2002)

Wood screws secured the window covering to an aluminum window frame. Over time, the screws became loose and worked their way out of the frame. The personnel who installed the covering on this window and on others at the facility should have bolted the Masonite to the window frame using bolts, nuts, and washers rather than substituting wood screws.

Maintenance personnel removed the Masonite coverings from all windows in the building. The Operating Safety Committee will generate and distribute a lessons-learned statement on the hazard of using wood screws to secure materials to metal frames.

A number of events have been reported involving objects falling or posing potential hazardous conditions simply because they were secured with incorrect fasteners. Examples include the following. On May 29, 2001, at the National Energy Technology Laboratory, operators discovered a potential projectile hazard when they found a 2-inch conduit coupling connected to a 2-inch pipe nozzle on a combustion vessel. Because the combustion vessel becomes highly pressurized, experts calculated that if the conduit fitting had come free at a pressure of 300 psig, it would have been launched at a velocity of 43.7 feet per second, or 30 miles per hour. The analysis concluded that the use of a conduit fitting rather than a pipefitting presented a significant potential for a near-miss incident. (ORPS Report HQ--GOPE-NETL-2002-0007)

In an office at the Los Alamos National Laboratory on April 6, 2001, empty shelves fell when the track mountings that supported them disengaged from the wall. Facility workers installed the tracking using equipment they obtained from a local hardware store, 5/8-inch-long screws with plastic fasteners. The holes that were drilled for the screws and fasteners were too large, and the screws were too short to penetrate the fasteners. The supplier had originally been scheduled to perform the installation using 1½-inch-long screws with cement wall fasteners designed to expand when screws are driven into them. Because the work order changed before the equipment supplier arrived to install the tracking, facility management chose to use its own maintenance personnel instead. However, the maintenance workers did not analyze the task before proceeding. No one occupied the office at the time, and no one was injured. (ORPS Report ALO-LA-LANL-HRL-2001-0001)

These events illustrate the importance of using the proper equipment for the task. The use of the wrong equipment in these events created the potential for worker injury.

KEYWORDS: *Near miss, screws, falling objects, human error*

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

2. NEAR MISS – WORKER CUTS INTO ELECTRICAL CONDUIT

On October 28, 2002, at the Rocky Flats Environmental Technology Site, an electrician removing conduit cut part way through electrical conduit that was not marked for removal and narrowly missed cutting into an energized 480-volt conductor inside. The electrician immediately stopped cutting when a co-worker pointed out that the conduit was unmarked and thus outside the scope of the work package. No sparks, smoke, or circuit breaker trips were observed, indicating that the insulation probably was not damaged. No one was injured as a result of this event, but because of its potential for serious injury it was categorized as a near miss. (ORPS Report RFO--KHLL-374OPS-2002-0003, final report issued November 27, 2002)

Electricians were removing conduit from a facility as part of decontamination and decommissioning (D&D) work. The conduit they were to remove was marked with black tape to indicate that all electrical wiring had been removed. The electrician began to cut into the unmarked conduit, but realized his mistake as soon as his co-worker told him to stop cutting. An inspection of the ¾-inch conduit indicated that the electrician cut through approximately ½ inch of its outer circumference. The electrician was familiar with the markings on the conduit, and had properly removed similar conduit in the past. He stated that he momentarily lost focus on the task he was performing.

Facility managers immediately suspended all electrical D&D work activities pending an investigation of the incident and implementation of corrective actions.

Investigators determined that both the direct and root causes of this occurrence were inattention to detail on the part of the electrician. The electrician was not focused on what he was doing and cut into the conduit without checking for the black tape that marked the conduit for removal. A serious injury could have occurred if his co-worker had not intervened.

The work package did not require the use of personal protective equipment (PPE) because the task involved cutting only marked conduit from which all electrical conductors had been removed and was not considered hazardous. To avoid a similar incident, the project manager will require workers to use electrical PPE when tasked with cutting conduit that has not already been removed and placed on the floor. Until the project manager formally waives this requirement, workers must use the following PPE.

- flame-resistant coveralls
- electrically insulated tools
- dielectric (electrically insulated) gloves
- electrically insulated mats

Additional compensatory and corrective actions resulting from this occurrence included revising electrical work packages to require PPE, briefing all electrical D&D workers on this requirement, and disseminating a lessons-learned document about this incident.

In June 2002, the Office of Environment, Safety and Health (EH) issued *A Review of Electrical Intrusion Events at the Department of Energy: 2000 – 2001.* This report contains an analysis of 63 electrical intrusion events reported in the DOE Occurrence Reporting and Processing System from January 2000 through December 2001 (URL http://tis.eh.doe.gov/paa/reports.html). Problems identified in this special report included inaccurate as-built drawings, noncompliance with procedures, lack of zero energy checks, and inadequate work practices. A lessons-learned report on this topic (HQ-EH-2002-01) can be accessed from the website for the Society for Effective Lessons Learned Sharing at http://tis.eh.doe.gov/ll/listdb.html. Information on electrical safety practices in DOE can be found in the EH Office of Performance Assessment and Analysis document, *Electrical Safety Report,* dated May 21, 1999, and in the DOE Handbook DOE-HDBK-1092-98, *Electrical Safety,* available at the following URL. http://tis.eh.doe.gov/techstds/standard/hdbk1092

This occurrence illustrates the importance of minimizing human errors by remaining focused on the work being performed, paying attention to detail, and avoiding distractions when working near potential hazards such as electrical systems. Also, it underscores the need for all personnel to observe what is going on around them in the workplace and to immediately take action if an unsafe condition is observed. For example, intervention by an alert co-worker prevented a serious injury in this event.

KEYWORDS: *Electrical safety, electrical intrusion, energized conductor, personal protective equipment, D&D activities*

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

3. WATER SPRAY DAMAGES ENERGIZED ELECTRICAL EQUIPMENT

On November 7, 2002, at the Pantex Plant, a subcontractor was flushing a strainer on a fire protection system when water spray from a defective fire hose entered an energized uninter-

ruptible power supply (UPS) system, causing it to trip. No one was injured, but the UPS system suffered minor damage. (ORPS Report ALO-AO-BWXP-PANTEX-2002-0057; final report filed January 6, 2003)

Figure 3-1. Equipment room arrangement

The subcontractor was flushing the strainer on a riser for a deluge system in accordance with Pantex testing requirements. Workers had set up to flush the strainer in an equipment room that housed an emergency UPS. A fire hose was connected to the strainer to direct flush water outside the building. One worker was inside the building to open a valve on the riser while another worker was outside to hold the fire hose over a wire screen to collect debris from the flush. Figure 3-1 shows the equipment room arrangement with hose (blue) connected to the strainer (gray) and the damaged UPS panel on the left.

A Pantex fire protection engineer, who was inside the building to observe the flush, mentioned to the worker stationed at the valve that he might get wet. The engineer and the project superintendent had noticed the hose leaking during previous flushes in the building cells. When the worker opened the valve on the riser he saw a stream of water spray from the nipple connection on the fire hose and hit the ceiling and I-beams above. After 30 seconds the fire protection engineer told the worker to close the valve. The worker closed the valve and went outside to help roll up the hose. While rolling up the hose, the two workers heard a loud boom and saw a flash.

The boom and flash were caused by water dripping from the ceiling onto a two-unit emergency UPS system. Electricians were able to restore power to the one of the units, but the other suffered internal water damage that required replacing several circuit boards.

The direct cause of the event was the defective fire hose, which had developed a hole near the nipple that connected to the riser (Figure 3-2). Pantex sent a letter to all contractor and subcontractor organizations informing them of their responsibility for identifying and removing defective equipment and explaining their liability for repair or replacement costs for any damaged equipment.

The root cause of this event was a work organization/planning deficiency because personnel failed to properly prepare themselves or their equipment to perform the flush. Although vari-

Figure 3-2. Defective fire hose

ous plant organizations met to discuss safety issues related to flushing and flow operations in the cells, they failed to evaluate safety issues associated with the equipment room. Subject matter experts in electrical and safety processes, as well as personnel knowledgeable about the equipment in the work area, could have provided valuable input regarding the strainer installation.

The causal analysis identified the following contributing causes associated with this event.

1. The testing procedure was inadequate because it failed to identify safety concerns that could occur during flushing (e.g., protecting electrical equipment and taking action if equipment malfunctioned or was damaged). Fire protection engineers will modify all flow-testing and flushing procedures to indicate that personnel are to stop work if a hazard exists or if performing the work could create a hazard (e.g., water hoses used near electrical panels or equipment, or temporary testing gauges not normally present that have the potential for water spray). Also, a means will be established to ensure hoses and other water sources are not frayed or damaged.

2. The design of the strainer system was inadequate because a construction change authorization issued to install the strainer system did not address how water would be discharged during a flush. Hard piping in lieu of a fire hose was not considered. To preclude recurrence, the subcontractor hard-piped the discharge from the strainer to the fire riser main drain.

3. Subcontractor personnel and Pantex fire protection engineers failed to recognize the potential hazards posed by the leaking hose and take action to remove it from service, even though they had several opportunities to do so before this incident occurred. The subcontractor superintendent detected two pinholes in the hose on November 4 and used his hand to cover one pinhole while pressing his leg against the second pinhole to control the water. On November 6, the fire protection engineer also detected a pinhole in the hose. Neither the subcontractor nor the fire protection engineer believed the holes presented a safety problem.

This event underscores the importance of personnel stopping work when they identify defective equipment and removing it from service. Using defective equipment, as in the case of the leaking fire hose, can cause damage to other equipment. Replacing the damaged fire hose before commencing the flushing operation would have prevented damage to the emergency UPS. It is important for contractors and subcontractors to take necessary precautions to ensure a safe working environment exists and that reliable equipment is provided to support the job.

KEYWORDS: *Water spray, electrical equipment, damage, fire hose, defective equipment, leak, UPS*

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

4. NEAR MISS AS STEEL PLATE SLIPS FROM LIFTING FIXTURE

On December 3, 2002, at the Rocky Flats Environmental Technology Site, workers were removing a 170-pound steel plate from a wall when it slipped from a field-designed, wooden lifting fixture. The plate then swung into a scaffold on which a worker was standing, causing the scaffold to partially tip over and fall against an adjacent piece of equipment. The steel plate subsequently fell free of the lifting fixture and dropped approximately 12 feet to the floor. No injuries or serious equipment damage resulted from this near-miss event. (ORPS Report RFO--KHLL-D&DOPS-2002-0001)

The steel plate was approximately 2 feet by 4 feet by ½ inch thick. The operators and supervisors involved in the event had been properly trained and qualified for lifting and handling operations. The rigging arrangement consisted of a rope-operated block and tackle hoist attached to an overhead crane trolley, with a web

sling and shackles connecting the hoist to the adjustable wooden lifting fixture. The workers had used the lifting fixture (shown in Figure 4-1) the previous day and had already successfully removed about 25 plates from the lower rows. Figure 4-2 shows the wall with lower plates removed (empty mounting studs) and upper plates still attached to the mounting studs.

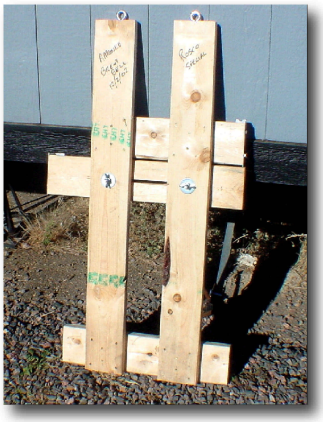

Figure 4-1. Field-designed lifting fixture

Immediately before this event, the bottom plate retaining bracket on the lifting fixture had been engaged with the bottom edge of the plate. Workers removed the nuts on the mounting studs holding the plate to the wall and freed the plate from the mounting stud. They were uprighting the plate to install a clamp on the top edge for added stability when it shifted and came loose from the bottom retaining bracket.

The bottom edge of the plate and lifting fixture moved uncontrollably outward from the wall, pushing the scaffold and causing it to tip out away from the wall. When the bottom of the plate had moved far enough from the wall to allow the top edge to clear it, the plate flipped downward, slipped completely out of the lifting fixture, and fell to the floor. The worker held onto the scaffold when the steel plate hit it and, after the scaffold stabilized against the adjacent equipment, climbed onto the equipment and subsequently descended a portable ladder. Figure 4-3 shows some of the damage to the scaffold.

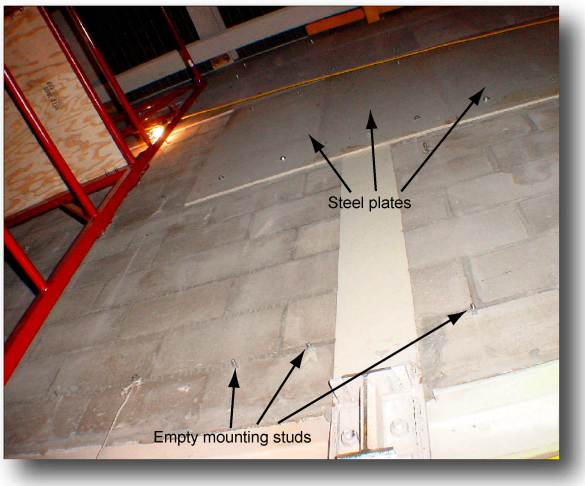

Figure 4-2. Wall with mounted steel plates

Figure 4-3. Scaffold damage

Investigators identified several causal factors. Contrary to established procedures, neither the appropriate manager nor his designee approved the rigging plan. Supervisors and operators did not stop work and evaluate the situation when two plates partially slipped out of the lifting fixture earlier in the day. The field-designed lifting fixture did not comply with Occupational Safety and Health Administration (OSHA) regulation 29 CFR 1926.251, *Rigging Equipment for Material Handling,* section (a)(4), which specifies that "Special custom design grabs, hooks, clamps, or other lifting accessories, for such units as modular panels, prefabricated structures and similar materials, shall be marked to indicate the safe working loads and shall be proof-tested prior to use to 125 percent of their rated load." The lifting fixture was not marked to indicate a safe working load, nor had it been proof-tested before use.

In addition, the documented hazards analysis for the work was not specific enough for the complexity of the lifting operation being performed. After the fact-finding meeting, investigators determined that the scaffolding did not meet OSHA regulation 29 CFR 1926.451(c), *Criteria for Supported Scaffolds,* which requires that the scaffold be restrained from tipping by

use of guying, tying, bracing, or equivalent means when the height to base width ratio exceeds 4 to 1. The ratio for this scaffolding exceeded 4 to 1, but no restraint was provided.

Compensatory and corrective actions resulting from this occurrence include the following:

- Stop all facility work and conduct a safety stand-down.
- Conduct refresher training on stop-work authority during the project safety stand-down.
- Conduct refresher training on scaffolding erection, inspection, and use requirements.
- Conduct a review of the plate removal operation and obtain appropriately designed and tested equipment.
- Develop and implement a project policy requiring peer review of all design and testing activities related to special hoisting and rigging equipment.
- Conduct a comprehensive review of the plate removal operation and implement appropriate changes to the hazards analysis and associated work documents.

A search of the Occurrence Reporting and Processing System revealed two other events in the DOE complex where loads slipped from their rigging devices. On November 4, 2002, at this same Rocky Flats facility during disassembly of a jib crane, the upper portion of the crane slipped out of its rigging and fell approximately 4 feet to the floor. There were no injuries and no major equipment damage as a result of this event. (ORPS Report RFO--KHLL-NONPUOPS1-2002-0007) On June 13, 2001, at the Fermi National Accelerator Laboratory, a 30-foot long, 2000-pound lattice support structure was being raised into position when it slipped out of one of its straps and fell a few feet, striking a manlift occupied by two workers. One of the workers broke two ribs, and the other sustained hand lacerations. (ORPS Report CH-BA-FNAL-FERMILAB-2001-0005)

These occurrences underscore the need to exercise great care in the use of lifting devices and rigging arrangements for hoisting heavy objects. Stop-work authority needs to be exercised whenever unusual conditions arise that could compromise worker safety. OSHA requirements for hoisting and rigging, as well as for constructing and using scaffolds, need to be complied with at all times. OSHA regulations and standards can be accessed at http://www.osha.gov/comp-links.html. *DOE guidance on hoisting and rigging can be found in DOE-STD-1090-2001,* Hoisting and Rigging *(URL* http://tis.eh.doe.gov/techstds/standards/std1090_c/toc2001.html*).*

KEYWORDS: *Hoisting and rigging, falling objects, lifting fixture*

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