Operating Experience Summary

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Inside This Issue

Helping the field succeed with safe and reliable operations.

Failure to Install Guard on Table Saw Results in Loss of Finger

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On January 11, 2006, at Idaho National Laboratory (INL), an electromechanical technician operating a table saw (Figure 1-1) lost the little finger of his right hand when the rotating blade of the saw cut across his palm from the base of his little finger to the area between his thumb and index finger. The blade guard was not installed on the saw when the accident occurred, and the technician was wearing leather gloves, contrary to instructions in the operator's manual for the table saw. The technician also sustained serious injury to the ring and middle finger of his right hand, as well as damage to his index finger, and underwent extensive reconstructive surgery. (ORPS Report NE-ID--BEA-INLLABS-2006-0001; final report filed May 2, 2006)

Figure 1-1. Table saw at accident scene

The technician was a new hire whose position description did not require carpentry skills or the ability to use a table saw. On the third day of his employment, with minimal general training and little instruction on operating the table saw, the technician was assigned to rip-cut plywood pieces, as well as ETHAFOAM900®.

ETHAFOAM900 is a semi-rigid polyethylene foam product that is difficult to cut with a table saw, especially as the larger sheet is cut into a sheet of decreasing width.

The technician first used a push stick during saw operation as he sized a piece of plywood. A laboratory custodian observed the cutting operation, and the technician experienced no problems using the saw to perform the task. The technician then had to make three dado cuts in the plywood (see Figure 1-2), which required removal of the blade guard assembly. When he completed this task, he took his scheduled break, without replacing the blade guard. When he returned from his break, the technician began rip-cutting the ETHAFOAM.

Cutting the foam required the blade guard to be in place; however, the technician did not replace it, and the custodian, who observed only the first cut, did not notice it was not in place and did not make any notes regarding worker safety or performance problems. After the custodian left, the technician had difficulty controlling the foam while cutting it. Because he was a new hire, he was uncomfortable with asking for assistance, so he decided to stop using the push stick and began using his hands to guide the piece, placing both hands on the

Figure 1-2. Dado cuts in plywood

scrap portion (the side where the blade was located) of the foam. As he was completing the final cut, the foam kicked back unexpectedly, and his right hand came in contact with the saw blade. Figure 1-3 shows the piece of foam that the technician was cutting when the accident occurred. (Evidence that the material kicked back can be seen in the photo.)

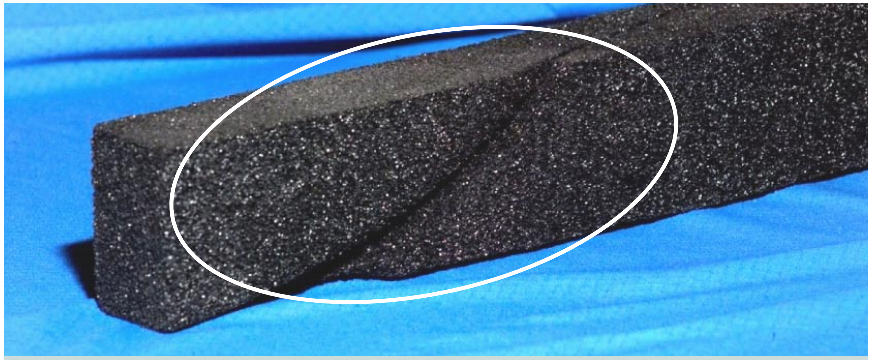

Figure 1-3. Piece of ETHAFOAM900® post-accident, showing evidence of kickback (circled)

A Type B Accident Investigation Board determined that, although the failure to ensure that the blade guard assembly was in place was the root cause of the accident, the technician had been allowed to perform work without the requisite training and without assurance that his competence was commensurate with the job he was tasked with performing. They also determined that work assignments were made before the technician completed the basic training elements needed to operate shop equipment. In addition, the Board learned that instructions on using the blade guard assembly had not been clearly communicated to the technician and that he believed the blade guard assembly needed to be removed when cutting the ETHAFOAM.

The Board concluded that project work activities were not adequately identified and compared with the hazards and controls in the Job Safety Analysis (JSA) to ensure that unanalyzed hazards were not introduced into the workplace. Work in the facility was matched to the most applicable JSA rather than analyzing the hazards for each activity. The Board identified several problems with the JSA used by the technician, including the following.

- The JSA was originally developed to address machine shop and fabrication work and did not include hazards and controls specifically applicable to table saw use or incorporate the saw manufacturer's safety warnings.
- The JSA did not include hazards and controls specified in OSHA Standard 29 CFR 1910.213 requiring the use of guards and push sticks.
- The JSA failed to identify the conflict between the direction to wear gloves during saw operation and the prohibition against wearing them specified in the operator's manual.

The Board concluded that the five Integrated Safety Management core functions were not implemented in the work control procedure used for this task. The procedure, which is normally used for research and development (R&D) work, did not provide for the definition of work scope, did not adequately control the performance of work, and did not provide a means for worker feedback. They also concluded that corrective actions from past events were not developed, implemented, and institutionalized to ensure full compliance with ISM principles to avoid preventable accidents.

The Judgments of Need identified by the Board included the following.

- Establish and institutionalize a formal process to confirm that workers are competent to perform work safely (commensurate with assigned responsibilities) before they perform work.
- Ensure that the work control procedure incorporates the five ISM core functions and ensure that job-specific work hazards are properly controlled before work begins.
- Ensure that JSAs identify and control the specific hazards associated with job tasks, are complete, include appropriate regulatory- and equipment-specific hazard control information, and are periodically assessed for effectiveness.
- Ensure that the hazard review screening process for new projects and work activities is compared against existing JSAs before work begins.
- Ensure that supervisors are provided with work instructions that are adequate and can be clearly communicated to, and understood by, workers.

A recent Lessons-Learned report (Lesson Identifier INL-BEA-LL-2006-021) provides additional information about this event and points out that there were missed opportunities to evaluate the safety aspects of projects and the deficiencies in existing JSAs. An earlier event at the INL Robotics and Human Systems Laboratory is an example of one of these missed opportunities.

On December 7, 2005, a researcher programming a radio-controlled helicopter for the Unmanned Aerial Vehicle Program suffered a compound fracture of his nose when one of the helicopter blades struck him in the face. (ORPS Report NE-ID--BEA-INLLABS-2005-0004)

The helicopter, a battery-powered, radio-controlled unit with a main rotor blade span of about 6 feet, was the first battery-powered helicopter assembled in the laboratory. Helicopters assembled previously were gasoline powered and the blades, unlike those of the battery-powered unit, did not move until the helicopter was started. The researcher had significant experience with the older helicopters, and he applied that knowledge to his work on the battery-powered vehicle. As a result, he did not recognize the hazards of the new task.

Investigators determined that, although evidence indicated that the speed controller on the helicopter may have malfunctioned, the failure to control a hazard associated with the unexpected startup of the helicopter was the direct cause of this incident. They determined that the existing Independent Hazard Review (IHR) did not adequately address hazards related to the new project (i.e., assembling the battery-powered helicopter), which represented a significant change in scope for the program. The investigators concluded that a hazard assessment should have been performed before operating the new equipment and the IHR should have been reviewed for adequacy and updated to include a hazard assessment and controls specific to battery-powered helicopters.

The objective of ISM is to perform work in a safe and environmentally sound manner. As described in DOE P 450.4, *Safety Management System Policy*: "The Department and its contractors must systematically integrate safety...into all facets of work planning and execution." DOE requires its contractors to "manage and perform work in accordance with a documented Safety Management System," as stated in section 970.5223-1, "Integration of environment, safety, and health into work planning and execution," of 48 CFR 970.52, *Management and Operating Contracts*.

Regulations in 48 CFR 970.52 also require contractors to ensure that “personnel possess the experience, knowledge, skills, and abilities necessary to discharge their responsibilities,” as well as requiring them to “evaluate the associated hazards before work is performed” to ensure employees, the public, and the environment are protected from adverse consequences. In addition, section 970.5223-1 requires tailoring administrative and engineering controls to the work being performed and to the associated hazard and states that emphasis should be on “designing the work and/or the controls to reduce or eliminate the hazards.”

These events point out the importance of ensuring that ISM core functions are properly implemented in work controls. It is essential to define the scope of work, to identify any hazards associated with a task, and to provide workers with a method for reporting any difficulties that arise while performing a task. It is also essential to ensure that corrective actions for previous events are implemented and institutionalized to prevent a recurrence that could result in serious injury or a fatality.

KEYWORDS: *Amputation, finger, table saw, blade guard*

ISM CORE FUNCTIONS: *Define the Scope of Work, Analyze the Hazards, Develop and Implement Hazard Controls, Perform Work within Controls, Provide Feedback and Continuous Improvement*

Good Practice: Stop Work and Re-Evaluate Hazards When Conditions are Uncertain

2

DOE Order 440.1A, *Worker Protection Management for DOE Federal and Contractor Employees*, establishes the stop-work authority that is granted to each DOE Federal and contractor worker if he or she discovers a condition that is potentially unsafe or that deviates from the original work plan. In April, 2006, at the Department's Sandia National Laboratories, a construction contractor employee exemplified the value of this principle when he consulted a radiological control technician (RCT) before beginning welding activities. This event is described in further detail below.

The construction contractor was tasked with remodeling a building. Part of this work required welding steel plates on an exterior blast wall (Figure 2-1) that was not posted as a radiological area. Because the work package did not include the welding task, the contractor employee asked an RCT, who was surveying material being removed from the building, if the steel plates could be welded. The RCT replied that before welding could begin, a radiological jobsite hazard evaluation would be necessary because of the possibility of radiological contamination on the wall. The RCT scanned the wall and verified the presence of fixed radioactive contamination. The contractor suspended work on the blast wall and roof of the building until a more detailed survey could be performed. (ORPS Report NA--SS-SNL-NMSITE-2006-0001)

The building and surrounding area had been characterized as a remediation site in 1987. The site report stated that the surface soil contained the following hazardous substances:

> Slightly elevated levels of metals, explosives, Th [thorium]-232, U [uranium]-235, and U-238.... Preliminary risk assessments indicate that the levels would not pose an unacceptable risk. There may be structures or stored materials that remain at the site that are a potential hazard.

In June 2003, following remediation activities to clean the soil, Sandia submitted a "No Further Action" proposal to the New Mexico Environmental Department, which deemed the site suitable for this designation in March 2004.

Figure 2-1. Exterior wall of building

On April 12, the RCT performed a comprehensive survey of the wall and detected elevated levels of fixed contamination that is believed to be depleted uranium. These contamination levels did not require posting in accordance with 10 CFR 835, *Occupational Radiation Protection*; however, they exceeded the values that require items to be labeled to warn individuals of the presence of radioactive contamination. The wall was subsequently labeled with "Fixed Contamination" stickers, and will be surveyed for gamma contamination; an adjacent roof will also be surveyed.

Historically, many events that have been reported in ORPS occurred because workers did not stop work and re-evaluate a changed or uncertain condition. The construction contractor employee received a commendation for taking the extra step of consulting with the RCT to verify working conditions before welding the steel plates.

This incident demonstrates the importance of proper work planning, thorough job walkdowns, effective hazardous work permits, and stopping work to re-evaluate hazards whenever uncertainty exists in the work scope. If the contractor had not requested and received timely information from the RCT, unauthorized welding may have been performed without the appropriate work controls, leading to potential hazardous exposures and the spread of radiological contamination.

KEYWORDS: *Good practice, radiological contamination, stop work*

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

Lessons Learned on Electrical Near Miss Lead to Improved Procedures

3

Issue 2005-14 of the Operating Experience Summary described the September 21, 2005, near miss that occurred at the Hanford Central Waste Complex when the bed of a subcontractor dump truck caught on a live 240-volt overhead power line and snapped it, causing an arc (see Figure 3-1). The driver was not injured; however, he got out of the truck without confirming that the power line was de-energized—a situation with the potential for electrocution. (ORPS Report EM-RL--PHMC-SOLIDWASTE-2005-0010; final report filed November 14, 2005)

A root cause analysis team investigated the event and determined that it resulted from the following:

- poor communication between the subcontractor and personnel in charge;
- inadequate oversight of subcontractor activities;
- lack of a dedicated spotter; and
- confusion over roles and responsibilities.

The contractor submitted a lessons-learned document (Lesson Identifier 2005-RL-HNF-0044) to the Project Hanford and DOE Lessons Learned web sites pointing out the importance of (1) clear communication between offsite vendors and site points of contact, (2) safety oversight of such subcontractors, and (3) the need to remain in a vehicle that has struck a power line until verifying that the line is de-energized.

The Office of Environmental Management (EM), Hanford's Program Secretarial Office, issued EM Safety Alert 2005-01 in December 2005. The Safety Alert described EM's concerns about 15 electrical near misses involving overhead lines at its sites since January 2004. Although none of these events resulted in electrical shocks or injuries, the Safety Alert points out that circumstances surrounding the DOE events were alarmingly similar to those for fatalities that have been reported to OSHA.

Figure 3-1. Truck bed caught on power line

To prevent this type of occurrence in the future, the contractor implemented a supplemental Management Directive entitled *Equipment Operation Near Overhead Electrical Lines*. This directive requires establishing a minimum of two barriers for equipment operation in proximity to communication lines and overhead electrical power lines (greater than 50 volts). One mandatory barrier is using a trained spotter, engaged in spotting for only one equipment operator, who is in full communication with the operator throughout equipment movement. These controls are in accordance with the requirements established in NFPA 70E-2004, *Standard for Electrical Safety in the Workplace*, and 29 CFR 1910.333(c)(3)(iii), *Vehicular and mechanical equipment*.

Other controls in the directive are summarized below.

- Have electrical utility personnel measure the line height, using remote measuring techniques, to provide spotters with a known clearance distance.
- Install physical barriers to keep equipment from entering the limited approach boundary.

- Place stakes or paint lines to help guide operators and spotters.
- Use reflective materials to increase visibility.
- Post signs to advise operators of clearance distance.

If none of the above controls is used, an alternative can be used with approval from the site interpretive authority for NFPA 70E.

The contractor took the additional action of writing a site procedure, *On-Site Material Deliveries*, which specifically addresses subcontractor deliveries. Excerpts from the procedure are listed below.

- The contracting representative will identify a contractor point of contact (POC) for a subcontracted delivery and notify him or her of the details.
- The dedicated POC will communicate with the subcontractor, schedule the delivery, and arrange for badging.
- The POC will walk down the offload location and brief the subcontractor before the delivery takes place, noting potential hazards and controls.
- The POC will meet the subcontractor at a designated location, escort the vehicle to its destination, oversee the delivery, and escort the subcontractor offsite when the delivery is complete.

The EM Safety Alert also stressed the importance of planning work to properly define work scopes for tasks near overhead power lines, identify the hazards associated with the overhead lines, and develop the appropriate controls. The Alert also emphasized that the preferred hazard control is to de-energize overhead electric lines when work will be conducted in proximity to them.

The Office of Environment, Safety and Health (EH) recognizes the significance of the electrical near misses caused by DOE contractors and subcontractors striking energized overhead power lines. EH applauds the DOE program-wide management directive established by EM to address the adverse trend of overhead line strikes. EH also commends Hanford for the corrective actions taken to prevent future occurrences of this type: establishing two solid barriers to avoid overhead power line strikes by industrial equipment; and implementing a formalized procedure that stresses good communication, oversight, and management of subcontractors.

KEYWORDS: *Dump truck, overhead power line, subcontractor, spotter, near miss, electrical safety*

ISM CORE FUNCTIONS: *Define the Scope of Work, Analyze the Hazards, Develop and Implement Hazard Controls, Provide Feedback and Improvement*

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Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
ANSI	American National Standards Institute
CPSC	Consumer Product Safety Commission
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
mg	milligram (1/1000th of a gram)
kg	kilogram (1000 grams)
psi (a)(d)(g)	pounds per square inch (absolute) (differential) (gauge)
RAD	Radiation Absorbed Dose
REM	Roentgen Equivalent Man
TWA	Time Weighted Average
v/kv	volt/kilovolt

Job Titles/Positions	
RCT	Radiological Control Technician

Authorization Basis/Documents	
JHA	Job Hazards Analysis
JSA	Job Safety 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
D&D	Decontamination and Decommissioning
DD&D	Decontamination, Decommissioning, and Dismantlement
RCRA	Resource Conservation and Recovery Act
TSCA	Toxic Substances Control Act

Miscellaneous	
ALARA	As low as reasonably achievable
HEPA	High Efficiency Particulate Air
HVAC	Heating, Ventilation, and Air Conditioning
ISM	Integrated Safety Management
MSDS	Material Safety Data Sheet
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control
SME	Subject Matter Expert