OPERATING EXPERIENCE SUMMARY

Inside This Issue

U.S. Department of Energy
Office of Environment, Safety and Health
OE Summary 2004-04
February 23, 2004

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 A REVIEW OF HOISTING AND RIGGING EVENTS

The Office of Environment, Safety and Health recently published *Department of Energy Hoisting and Rigging Events*. Hoisting and rigging activities typically involve the lifting, moving, and laying down of heavy loads. These tasks require careful planning, preparation, and implementation by a variety of individuals, including managers, work planners, supervisors, riggers, spotters, equipment operators, and maintenance personnel.

The purpose of this report is to describe the commonly made errors in these incidents and to identify the lessons learned and specific actions that should be taken to prevent similar incidents from recurring.

The report can be accessed at the URL **http://www.eh.doe.gov/HR_INPO_Style_FinalDraft_01-20-04.pdf**

EVENTS

1. ELECTRICIAN VIOLATES ELECTRICAL WORK SAFETY CONTROLS

On July 15, 2003, at the Hanford Solid Waste Storage and Disposal (SWSD) facility, a subcontractor electrician removed an air sampler without approval and without installing a lockout/tagout (LO/TO) on a circuit breaker to the air sampler cabinet. Subsequent investigation revealed that the electrician violated procedures for work release and hazardous energy control. Although no injuries resulted from this occurrence, working on electrical equipment without placing positive controls on the energy source can result in an electrical shock. (ORPS Report RL--PHMC-SOLIDWASTE-2003-0008; final report filed September 3, 2003)

Subcontractor workers were performing process upgrades in the SWSD facility, including removing some electrical panels and an air sampler cabinet. The site M&O contractor controlled the timing of subcontractor work by issuing work release forms on a weekly basis that authorized the work to be performed in that week. On July 15, 2003, the SWSD electrical supervisor and the subcontractor electrician walked down the air sampler cabinet power supply circuitry to establish boundaries for a planned LO/TO that was to be placed before electrical work was authorized. The air sampler was out of service, and the power supply circuit breaker was open.

After the walk-down, the electrician went back to the circuit breaker and confirmed that the circuit was de-energized using a voltmeter. He disconnected the remaining wires in the cabinet, pulled them out of the conduit that fed power to the air sampler, and removed the air sampler. That afternoon, his supervisor noticed that the air sampler had been removed and questioned the electrician. The electrician admitted removing the air sampler without a LO/TO, but stated that he knew the circuit was de-energized. The subcontractor supervisor confiscated the electrician's badge and removed him from the project. However, the supervisor did not report the incident to SWSD facility management, and the air sampler was replaced in its original position.

On July 17, 2003, while conducting a walkdown of the proposed LO/TO, the SWSD facility operations manager discovered that the air sampler had already been removed without a work release and without the installation of a LO/TO. He halted all subcontractor work in the facility. After investigators learned that the electrician's supervisor had not reported the incident, the facility operations manager confiscated the supervisor's badge and removed him from the project. He also suspended subcontractor work until all subcontractor personnel were briefed on the work release process and LO/TO requirements and a recovery plan was submitted.

Investigators identified multiple human errors in judgment by the electrician and his supervisor as the direct cause of this occurrence. They determined that the root cause was misuse (or in this case non-use) of established procedures for work control, hazardous energy control, and reporting of abnormal events.

SWSD management considered this a significant incident because the subcontractor agreed to comply with established safety programs, but did not. Because subcontractor personnel did not follow established procedures, SWSD facility management must depend on the subcontractor to successfully implement actions to prevent the occurrence of similar events.

Corrective actions taken as a result of this occurrence included the following.

- Require the subcontractor to submit an acceptable recovery plan before work restart.
- Implement a work control briefing for all new subcontractor personnel to address safety, work authorization, and event reporting requirements.
- Revise the work management plan to incorporate the new subcontractor briefing process.
- Revise the facility emergency hazards information control training program to incorporate the new subcontractor briefing process.

- Disseminate a lessons learned document on this occurrence.

A search of the ORPS database revealed several similar occurrences. On February 10, 2003, at the Nevada Operations Office, a subcontractor electrician received a burn to the little finger of his right hand and an exit burn on his right arm while replacing lighting ballasts. The electrician did not install a lockout/tagout on the 277-volt lighting circuit. (ORPS Report NVOO--GONV-GONV-2003-0001)

On July 15, 2002, at the Hanford Site, a journeyman electrician received minor flash burns to his forearm and neck while replacing a circuit breaker in an energized 480-volt, 1,600-amp distribution panel. While attaching a mounting screw, his screwdriver slipped and made contact with a breaker lug and a grounded mounting plate, creating an arc flash. To avoid facility down time, the electrician decided to install the breaker without de-energizing the panel, a blatant procedure violation. (ORPS Report RP--CHG-TANKFARM-2002-0075)

OSHA regulation 29 CFR 1910.147(a)(3)(i) states:

> This section requires employers to establish a program and utilize procedures for affixing appropriate lockout devices or tagout devices to energy isolating devices, and to otherwise disable machines or equipment to prevent unexpected energization, start up or release of stored energy in order to prevent injury to employees.

These events underscore the fact that violations of LO/TO procedures put workers at risk. A positive method of isolating the energy source from the item being worked on, such as installation of a LO/TO, is needed to ensure worker safety. Compliance with established electrical safety controls is not optional. Individual workers need to take responsibility for protecting themselves against electrical hazards in the workplace.

PROTECTING AGAINST WORKPLACE ELECTRICAL HAZARDS

- Use LO/TO processes if work may be performed in close proximity to energized conductors.
- Walk down the job site to establish the boundaries of a LO/TO application.
- Install a personal LO/TO on sources of hazardous energy associated with the work to be performed.
- Ensure that LO/TO procedures include independent verification of correct installation.
- Perform a zero-energy check before working on electrical components.
- Seek assurances that energy sources have been isolated, and then verify that this is so.
- Perform work on energized circuits only after obtaining special approvals and developing job-specific safety controls.
- Use the proper electrically rated personal protective equipment for the work to be performed.
- Stop work and seek assistance if unanticipated hazardous energy sources appear to be present in the workplace.

KEYWORDS: *Lockout/Tagout, intentional violation of safety controls, hazardous energy controls, work authorization, control of subcontractors*

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

2. LACK OF EYE PROTECTION RESULTS IN SERIOUS EYE INJURY

On February 4, 2004, at the Hanford Tank Farms, a painter moving stanchions in a fabrication shop was struck in the eye by a steel washer on the end of a stanchion. The painter lost control of the 35-pound stanchion as he attempted to remove it from a saw horse, and the washer-end hit him, cutting his eye. The painter was not wearing eye protection, and his eye was severely damaged, requiring emergency surgery. (ORPS Report RP--CHG-TANKFARM-2004-0006)

The metal stanchion had an 18-inch by 18-inch steel plate base with a 42-inch-long pipe welded to the top of it. At each end, the pipe had a steel washer used to thread barrier tape through the stanchions. As the painter picked up the stanchion, the heavy bottom caused him to lose control of it, and the steel washer hit him in the eye. Although the fabrication shop was designated as an eye protection area, the painter had removed his approved, sunglass-type safety glasses when he entered the shop, leaving his eyes unprotected.

The painter had injured this same eye in the past and had limited vision in it. He normally wore sunglass-type safety glasses because the eye was also sensitive to light. When he entered the shop from outdoors he could not see well because of the tinted lenses, so he removed his glasses. He could have picked up another pair of safety glasses in the shop, but apparently did not do so. The painter has not yet regained sight in the injured eye and will undergo additional treatment and surgery.

Occupational-related eye injuries are commonly caused by chemical splashes, metal or plastic debris hitting the eye, tools accidentally striking the face, and improper use of equipment. The Bureau of Labor Statistics (BLS) reports that each day as many as 2,000 workers incur eye injuries related to their jobs. However BLS found that three out of five workers who suffered an eye injury wore no eye protection at all. They also reported that most workers who were hurt while doing their regular jobs without protective eyewear said they did not believe eye protection was required for the task they were performing. Like them, the painter at Hanford most likely assumed that there was no reason for him to wear eye protection to do something as simple as picking up a stanchion, even though he knew eye protection was required when working in the shop.

Safety eyewear should be worn whenever there is any chance that machines or operations present the hazard of flying objects, chemicals, harmful radiation, or a combination of these or other hazards. Figure 2-1 provides a graphic example of why wearing safety glasses is imperative. An installer was applying siding with an air-powered staple gun when a staple hit a metal plate behind the siding and ricocheted back towards his face.

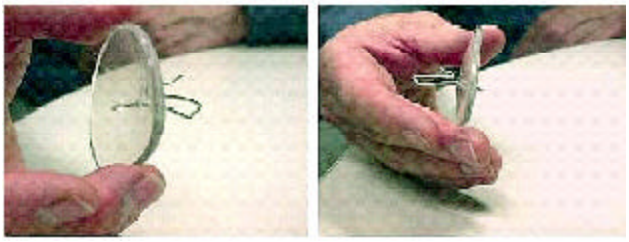

Figure 2-1. Metal staple lodged in safety glasses

As can be seen in the photograph, one leg of the staple penetrated the lens of the installer's safety glasses. The staple hit with such force that the frames of the glasses were cracked. The installer was badly bruised on his eyebrow and cheekbone, but sustained no injury to his eye.

Workers who wear corrective lenses should never assume they do not need to use protective eyewear. The American National Standards Institute (ANSI), which sets standards for safety glasses, requires them to withstand the impact of a quarter-inch steel ball traveling 150 feet per

PREVENTING EYE INJURIES AT WORK

ASSESS — Identify operations and areas that present eye hazards by inspecting work areas, access routes, and equipment and reviewing eye accident and injury reports.

PROTECT — Select protective eyewear designed for a specific operation or hazard. Ensure that eyewear meets current OSHA standards.

FIT — Have eyewear fitted by an eye care professional or by someone trained in fitting safety glasses so that protective eyewear fits properly and comfortably. Require workers to be responsible for their own eyewear.

EDUCATE — Conduct ongoing, mandatory training to maintain and reinforce the need for protective eyewear.

SUPPORT — Set an example. Management support is a key ingredient in successful eye safety programs. Management personnel should wear protective eyewear when and where it is required.

PUT IT IN WRITING— Display a copy of the eye safety policy in areas frequented by workers and include a review of the policy in the orientation process for new workers.

second. Safety glasses and goggles provide protection that prescription glasses, alone, cannot provide when performing tasks that present the potential for an eye injury.

For workers who normally wear corrective lenses, OSHA regulation 1926.102(a)(3) requires use of one of the following types of protective eyewear.

- Spectacles whose protective lenses provide optical correction.
- Goggles that can be worn over corrective spectacles without disturbing the adjustment of the spectacles.
- Goggles that incorporate corrective lenses mounted behind the protective lenses.

OSHA also requires workers who must wear PPE, including protective eyewear, to receive training in its use. Additional information on OSHA requirements can be accessed at www.OSHA.gov. A recent issue of the OE Summary (Issue 2004-01) reported on a researcher at Los Alamos National Laboratory who narrowly escaped serious injury when a solution of hydrochloric/hydrofluoric acid sprayed over the top of his safety glasses and into his eyes. The article includes ANSI Z87.1-1989 recommendations for eye and face protection, including those for wearers of contact lenses and prescription lenses.

These events illustrate that accidents can happen in an instant, and failing to wear personal protective equipment, whether it is eye/face protection or other required PPE, can be the difference between a serious injury and a minor one. Managers should ensure that all workers understand the necessity for wearing the correct eye protection for a task, as well as the importance of wearing eye protection over prescription glasses or incorporating their prescription into safety eyewear. In areas where safety glasses are required, they should be readily available at the entrance to the area.

KEYWORDS: *Personal protective equipment, eye injury, safety glasses, goggles*

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

3. USE OF INAPPROPRIATE TOOLS LEADS TO INJURIES

On November 11, 2003, at the Brookhaven National Laboratory, an air conditioning mechanic using pliers to remove the seal on a 55-gallon drum of propylene glycol cut his left index finger when the pliers slipped off the metal pull tab (Figure 3-1). The cut severed a tendon, requiring surgical repair. Investigators determined that the pliers were a commonly used but inappropriate tool for this skill-of-the-craft task. (ORPS Report CH-BH-BNL-PE-2003-0007; final report filed January 21, 2004)

Figure 3-1. Metal pull-tab

The mechanic wore cotton, leather-palmed gloves and was using 12-inch water-pump pliers in a rocking motion to open the seal. As he lifted up on the seal, the pliers slipped, and the metal tab cut across the top of the glove into his finger. The reconstructive surgeon stated that the gloves prevented a far more serious injury; nonetheless, the Laboratory purchased cut-resistant gloves and a bung and seal remover that will keep workers' hands out of the way of the seal as it is being removed.

Another event involving the use of an inappropriate tool for a skill-of-the-craft task occurred at Oak Ridge National Laboratory on October 29, 2003. A researcher was holding a band saw similar to the one shown in Figure 3-2 at about a 45-degree angle to cut notches in a stainless steel envelope. Investigators believe that

Figure 3-2. Saw similar to the one that cut the researcher

the blade caught on the envelope and pulled the researcher's hand into the blade. The researcher suffered a significant cut on his hand that required surgery, and he lost 63 days from work. (ORPS Report ORO--ORNL-X10CENTRAL-2003-0009; update/final report issued December 11, 2003)

The steel envelopes are usually notched using a smaller band saw (Wellsaw™) with a finer blade and a table rest designed for use with handheld stock. When the researcher tried to use it to notch the envelopes, the blade slipped off. The researcher decided instead to use the large coarse-toothed saw manufactured by Cosen.

The Cosen saw is designed to be used only in a horizontal position, with the piece clamped in place and safety guards in place. In addition, a rule of thumb for cutting pieces of metal is the "three-tooth" rule; that is, the piece being cut should be wider than three of the saw blade teeth to prevent the blade from catching and pulling the piece. These and other controls were specified in the operating manual, but the researcher did not follow them.

The laboratory issued a lessons-learned document to other potentially affected organizations and conducted retraining on safety requirements for using power saws. The training emphasized stopping work when encountering unsafe conditions.

The improper use or misuse of hand tools can cause minor to serious hand injuries. When the wrong tool is used, or the right tool is used improperly, hand injuries are likely to happen. Over 200,000 hand and finger injuries are reported annually as a result of job-related accidents.

These events illustrate the importance of using the appropriate tool for the job, even for skill-of-the-craft work that does not have a formal procedure. Substituting equipment and using workarounds without a hazard analysis can present the potential for injury.

KEYWORDS: *Seal, drum, injury, skill of the craft, bandsaw*

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

4. FIRST-AID PROCEDURES NOT FOLLOWED AFTER ACID BURN

On December 6, 2003, at the Savannah River Site, a technician working in a contamination area received a burn on her left palm when nitric acid leaked from an acid dilution vial onto her glove and burned through it. The technician did not follow laboratory first-aid procedures for flushing the burn or use the safety shower/ eyewash station after her injury. Fortunately she was not badly burned and required only an application of antibacterial ointment to the affected area. (SELLS Identifier 2004-SR-WSRC-0004)

The technician was preparing calibration standards using acid dilution vials (Figure 4-1) when she noticed that acid had leaked onto her gloves. She immediately took the gloves off and rinsed them in the sink. When she saw discoloration on the left glove (Figure 4-2) and felt a burning sensation on her palm, she realized she had been burned. Instead of immediately going to the nearest safety shower/eyewash station, the technician left the contamination area and went to the change room, where she flushed her hand for a short period of time. When she returned to the lab and told her manager

Figure 4-1. Acid vial

about the burn, he sent her back to the change room to continue flushing her hands for a full 15 minutes as required by the laboratory safety procedure.

After completing the second flush, the technician noticed a small red blister forming on her palm. She notified the laboratory Shift Operations Manager and went directly to the site medical facility for treatment. However, contrary to site procedures, no one notified the Radiation Control Office about the injury. More information about this event is available on the Lessons Learned website.

Corrective actions taken included reviewing flushing/washing procedures with all laboratory technicians to ensure they understand that the safety shower/eyewash station should be used after an acid burn, as well as the importance of a full 15-minute flush of the burn. Managers will also discuss the need to notify Radiation Control Office personnel with all laboratory personnel and will update the laboratory safety procedure to include steps detailing the notification process.

Figure 4-2. Damaged glove

Until the investigation is completed, technicians will wear a second pair of gloves when handling open acid containers. In addition, laboratory managers will evaluate whether technicians should use volumetric flasks instead of acid dilution vials when preparing standards in the future.

Chemical burns require urgent, effective first-aid. Acid or alkaline solutions that contact unprotected skin burn rapidly through tissue and must be quickly diluted and flushed with large quantities of water. It is essential to go to the nearest safety/eyewash station to flush the burn, dilute the acid, and wash away any particulates as quickly as possible. Using too little water can activate the chemical and produce devastating results; therefore, it is also crucial to adhere to the 15-minute flush requirement following a chemical burn to either the skin or the eyes.

Eyewash stations must be located near the hazard, have unobstructed access, and be properly maintained so they are ready for use in an emergency. OSHA requirements in 29 CFR 1910.151(c), *Medical Services and First Aid*, state that when the eyes or body of a worker may be exposed to injurious corrosive chemicals, suitable facilities for quick drenching must be provided in the work area for immediate use. There is also a close link between these requirements and those in 29 CFR 1910.1200(g), *Hazard Communication*, which requires employers to evaluate hazards and communicate specific information, including proper work practices and protective measures, to workers.

This event illustrates the importance of ensuring that workers are knowledgeable about first-aid procedures and follow them even if an injury appears to be minor. Workers who use hazardous chemicals should receive training in emergency first-aid, including use of eyewash stations and procedures for flushing chemical burns to the body or eyes.

KEYWORDS: *Acid, laboratory, eyewash station*

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

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienist
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 Requirements
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 reasonable 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