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 publishes a series of Just-In-Time reports on its Lessons Learned and Best Practices web site. These reports are targeted to work planners and workers and discuss safety topics relevant to the work they do. Each report presents examples of problems and mistakes encountered in actual reported cases and offers points to consider to avoid similar mistakes in the future.

EH plans to issue more Just-in-Times soon on other safety issues. All of the Just-in-Times can be accessed at http://www.eh.doe.gov/paa/jit.html.

EVENTS

1. *SHARP-EDGED LOAD CUTS RIGGING SLINGS*

On July 11, 2005, at the Idaho Reactor Technology Complex, construction workers were unloading a 5,400-pound concrete ring from a truck when the ring's sharp inner edge cut one of the slings (Figure 1-1) that supported it, causing the other sling to break and the load to drop. No one was near the ring as it dropped, and there were no injuries. The ring cracked and had to be replaced. (ORPS Report ID--BEA-RTC-2005-0002)

Figure 1-1. Cut slings

The manufacturer casts the concrete rings with a sharp inner edge (Figure 1-2) and two diametrically opposed holes in the mid-point of the outer wall. Long tapered pins are inserted into the holes so the rings can be moved safely after casting, but the manufacturer does not include the pins when the rings are delivered to their customers.

Figure 1-2. Lifting sling configuration

Hoisting and rigging work was identified as a hazard in the job safety analysis, which specified using padding on rough or sharp edges. The workers used an excavator with a manufacturer-installed lift point and two fairly new, 20-foot-long slings in a choker arrangement.

The excavator operator took up the slack in the slings to place the load under tension. Because the worker inspecting the slings thought that they appeared to pull away from the upper edge of the ring, the workers believed that they did not need to pad the upper edge of the ring and placed pieces of old fire hose only on the bottom edge, as shown in Figure 1-2.

The excavator operator lifted the ring about 6 inches above the truck bed and began moving it off the truck. As the ring cleared the truck bed, and the operator began lowering it to the ground, one of the slings was cut; the other failed under the shifted weight, and the ring fell about 3 feet to the ground. Aside from the excavator operator, all of the workers were at least 30 feet away from the ring when it dropped.

Hoisting and rigging work stopped so that the event could be critiqued. Work resumed after corrective actions (e.g., improving work planning and load inspection) were developed.

The OSHA Standard for Construction, 29 CFR 1926, contains requirements for padding slings in section 251(c)(9): "Slings shall be padded or protected from the sharp edges of their loads." More specific guidance for using lifting slings is found in the DOE Standard DOE-STD-1090-2004, *Hoisting and Rigging (formerly Hoisting and Rigging Manual).* Chapter 11, "Wire Rope and Slings," describes how to protect slings from chafing or sharp edges using padding material such as corner saddles, burlap padding, wood blocks, and leather pads.

A search of ORPS yielded several other events caused by slings that failed on rough or sharp edges.

- On February 17, 2005, at the National Renewable Energy Laboratory, personnel were performing a trial lift of a metal frame holding an extendable-boom forklift weighing about 5,100 pounds when the load shifted unexpectedly and an unprotected rough edge cut one of the slings. One side of the load dropped about 3 feet, but no injuries or damage resulted. The root cause was the rough edge that the workers had noticed, but neglected to protect against. (ORPS Report GO--NREL-NREL-2005-0002)

- On August 30, 2002, at Rocky Flats, as a subcontractor work group was performing a test lift of a 26,000-pound piece of equipment, a raised metal ridge near the bottom of the base cut the slings, causing the piece to drop about 6 inches. The qualified riggers who prepared the lift underestimated the weight of the piece and used leather work gloves to protect against the ridge, but the gloves proved to be inadequate. No one was injured, and there was no equipment or structural damage. (ORPS Report RFO--KHLL-NONPUOPS1-2002-0003; OE Summary 2002-20)
- On August 29, 2001, at the Brookhaven National Laboratory, one end of a Large Hadron Collider magnet fell approximately 4½ feet to a concrete floor when one of two slings was cut through because of inadequate chafing protection against a sharp edge of the magnet. (ORPS Report CH-BH-BNL-BNL-2001-0023; OE Summary 2001-09)

These events demonstrate the importance of properly planning for a lift. Sharp or rough edges should be padded or softened even if they do not appear to be cutting into the sling. Riggers should know the weight of the load and use padding materials that adequately protect slings from damage.

KEYWORDS: *Sling, rigging, near miss, sharp edge*

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

2. LACK OF TRAINING RESULTS IN WORKER EXPOSURES TO FIRE SUPPRESSION AGENT

On May 25, 2005, at the West Valley Demonstration Project, a fire suppression system discharged as three workers were evacuating the work area following an audible alarm. Operations personnel observing the workers were not aware that the alarm was a pre-discharge alarm for the fire suppression system or that a discharge was imminent. No personal contamination resulted from the discharge, and there was no spread of contamination. (ORPS Report OH-WV-WVNS-LAG-2005-0002)

Two D&D Waste Operations operators and a radiological control technician were packaging sample bottles in a sorting and packaging facility when they heard a loud alarm. A field supervisor observing work activities through a viewing window instructed the three workers to evacuate, although there was no indication of smoke or fire in the room. As the workers were evacuating, the fire suppression agent, heptafluoropropane (FM-200™) discharged, the ventilation system automatically shut down, and the dampers closed. All three workers immediately went to an assembly area, where they doffed their anti-contamination clothing. Radiation Protection Operations staff frisked the workers, performed nasal smears, and sent them for a whole-body frisk, but found no evidence of personal contamination. They also determined that there was no spread of contamination.

The FM-200 system was designed to activate automatically at 135° F or manually when the spring-clip safety pin is pulled and a button is pushed. Investigators believe that someone inadvertently activated the system manually. They determined that a worker performing housekeeping activities found the safety pin from the manual release switch and disposed of it as trash because he did not know it was an essential component of the fire protection system. The worker had not had sufficient training on facility support systems, and the focus of the training he did have was on housekeeping tasks.

Investigators also determined that not all personnel involved in the debris-sampling activities had completed training in responding to the fire detection and suppression system alarms and that no fire drills had been conducted.

Corrective actions for this event included a mandatory briefing of workers in areas protected by FM-200-type systems. Briefing topics included manual activation and abortion of system discharge, the hazards associated with FM-200, and alarm response. Training to demonstrate the audible alarms in the facility was also provided.

A similar event occurred at West Valley in March 2001, when smoke from a failed transformer caused the FM-200 system to discharge. Corrective actions for that event also included providing personnel with additional guidance on how to respond to FM-200 system activation.

Lack of training was a key factor in a fatality that resulted from a carbon dioxide (CO_2) discharge during an inadvertent fire suppression system actuation at the Idaho National Engineering and Environmental Laboratory (INEEL, now known as Idaho National Laboratory, INL) on July 28, 1998. A Lessons Learned bulletin about the event was published in December 1998. (DOE/EH-0564, Issue 98-1)

The discharge occurred while workers were opening electrical breakers to prepare for electrical system preventive maintenance.

Fire Suppression System Worker-Training Goals

Following training, all workers should:

- Understand the hazards associated with the fire suppression system.
- Know the meaning of all system alarms and the proper response to each.
- Know how to abort a system discharge if necessary.
- Be aware of individual responsibilities and actions to ensure their own safety and that of co-workers.

The room instantly filled with CO_2, creating whiteout conditions. Workers struggled to escape the potentially lethal atmosphere in poor visibility, with no clear exit pathways or pathway lighting and no emergency breathing apparatus or emergency ventilation. None of the workers had been trained in how to exit the area in an emergency. In addition to the fatality, several other workers received life-threatening injuries.

A Type A Accident Investigation Board determined that this accident was avoidable. Although the direct cause of the accident was the inadvertent activation of electrical control heads, which initiated the CO_2 release, the Board cited the workers' inability to deal with CO_2 hazards as a contributing cause. One of the lessons learned from this event was that "personnel working around or near CO_2 systems must first be trained on requirements, hazards, alarms, and emergency response."

A 1991 release at the Savannah River Site also could have been prevented had workers been provided with appropriate training. Workmen did not know that an open flame from a hand torch would activate the fire detection system, and the occupants in a computer room were never trained in how to abort the Halon system. There were no injuries as a result of the release, but approximately 780 pounds of Halon were released to the atmosphere. (SR--WSRC-EES-1991-0001)

Training is an essential element of any fire protection program. An online fire safety quiz developed by the Fire Equipment Manufacturer's Association includes several questions related to training, including: Have you conducted general fire [suppression] product training with building occupants and personnel?. In the 2005 West Valley event, adequate training on the fire suppression agent (i.e., FM-200) was not provided to the facility workers, to operations personnel, or to housekeeping staff, so they were unable to take the necessary actions to prevent or respond to the discharge.

DOE Order 420.1, *Facility Safety*, addresses fire protection in section 4.2.1, and the regulations in Subpart L of OSHA Standard 1910.162, *Fixed Extinguishing Systems, Gaseous Agent*, address fixed extinguishing systems that use gas as an agent. Specific requirements are provided for both CO_2 and Halon systems in Subpart L.

In addition, Appendix C to the subpart provides a list of fire-protection references, including National Fire Protection Association (NFPA) and ANSI standards.

These events demonstrate the importance of training personnel who work in areas where fire suppression systems can be activated. Workers must be familiar with all components of the system (including alarms), with the normal configuration and the proper response to alarms or other off-normal circumstances, and with abort procedures. Training in these areas is essential to ensuring that workers are aware of what actions to take in an emergency.

KEYWORDS: *Fire suppression, FM-200, carbon dioxide, halon, training, alarms, fatality*

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

3. WHAT'S IN YOUR EXCESS AND SURPLUS MATERIAL?

On July 11, 2005, at the Savannah River Site, Asset Management and Logistics group workers discovered an explosive squib (Figure 3-1) within a pallet of excess material. The pallet was part of an 18-pallet shipment that resulted from deactivation and decommissioning (D&D) activities. Upon discovery of the explosive, the facility was evacuated and emergency assistance was requested. There were no injuries. (ORPS Report SR--WSRC-FSSBU-2005-0006)

Workers found the explosive squib inside a cardboard box marked with a part number and the words "reload kit." The squib was completely

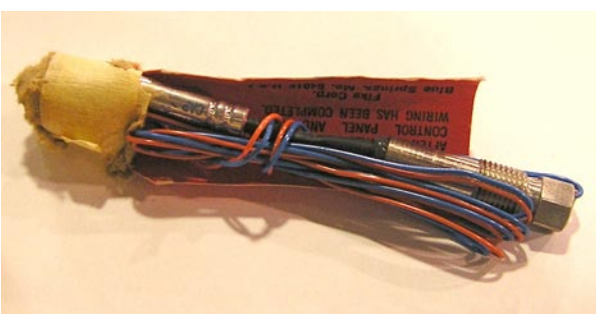

Figure 3-1. Explosive squib

wrapped in unmarked brown paper and tagged as a Class C explosive. In all, workers found three boxes containing explosive squibs, none of which was marked to indicate that the boxes contained explosives (Figure 3-2).

The squibs came from a facility that had been turned over to the site D&D organization. Investigators believe the squibs were used to actuate fire protection suppression systems and may have been in the facility since 1985. Apparently, during the process of removing material from the facility, site D&D personnel did not look through the containers adequately before sending them on to excess. Fortunately, Asset Management and Logistics personnel discovered the squibs during their export control review of pallets, thus preventing the explosives from being taken offsite, possibly to the public. The squibs were later rendered harmless in a controlled detonation.

On July 30, 2004, at the same facility, workers discovered radiological material in a crate that was not identified as containing such material. Radiological Control personnel moved the crate to a radiological materials area, where surveys confirmed that there was no surface contamination. Investigators determined that site D&D personnel did not look thoroughly through the crate, other than through the top level of material, and assumed that everything below was acceptable. The material was not properly packaged, labeled, or shipped. (ORPS Report SR--WSRC-FSSBU-2004-0004)

Office of Corporate Performance Assessment staff reviewed 120 occurrence reports involving problems with excess; salvage; and surplus materials, equipment, and property. The majority of these occurrences involved radioactive material, primarily in the form of contamination. In addition to radioactive materials and explosives, some events have also involved hazardous chemicals and materials and even classified information, as shown in the following examples.

- On September 13, 2003, at the Pacific Northwest National Laboratory, an industrial hygienist discovered that an explosion-proof refrigerator, known to have a low level of beryllium contamination, was missing. Laboratory personnel traced the

Figure 3-2. Box marked "Reload Kit" (not marked as containing an explosive)

refrigerator to a local community college, where it was on loan and being used for chemical storage. Investigators determined that the refrigerator had been excessed by personnel who were not aware that it was contaminated. The refrigerator was not marked as contaminated, but levels were in excess of public release limits. (ORPS Report RL--PNNL-PNNLBOPER-2002-0014)

- On December 6, 2001, at the Oak Ridge National Laboratory, staff members discovered that a vacuum pump that had been sent to salvage was later sold to a member of the public at auction, even though a radiological control technician who knew the location history of the pump, had advised against it. The pump was later retrieved from the purchaser's home Investigators learned that the pump had been sold before sample results for PCB contamination of the pump oil had been received. Fortunately, no PCB contamination was found. (ORPS Report ORO--ORNL-X10WEST-2001-0018)

- On June 19, 2001, at the Y-12 Site, four used utility poles were released to the public without being adequately surveyed for radiological contamination. Asset Management Organization staff had arranged the sale of the utility poles to a member of the public, who came to Y-12, cut the poles into pieces, and transported them offsite. Radiological Controls personnel went to the offsite location, surveyed the poles, and determined they were not contaminated. Y-12 procedures require radiological surveys of all material being released to the public. (ORPS Report ORO--BWXT-Y12SITE-2001-0020)

- On March 29, 1999, at the Lawrence Livermore National Laboratory, an employee found computer disks containing sensitive information in a salvage bin. Investigators determined that a worker, who was inspecting and certifying excess material that was being discarded from a property protection area, had overlooked the classified items. (ORPS Report OAK--LLNL-LLNL-1999-0009)

- On July 28, 1997, at Rocky Flats, an employee discovered an envelope containing a classified document that was in a file cabinet he had purchased at a public auction of government property at an onsite warehouse. The employee was unloading the cabinet at home when the envelope fell out. The document was returned to the site for proper storage. (ORPS Report RFO--KHLL-PROTFORCE-1997-0010)

In cases where hazardous materials are unknowingly shipped to salvage, DOT violations can also result. For example, on July 27, 2005, a salvage vendor discovered three americium-241 sources in a shipment of main steam line radiation monitors that had been shipped from a commercial nuclear power plant. Apparently, personnel at the nuclear plant were unaware that the monitors contained radioactive sources when they shipped them off to salvage. Consequently, they did not properly package or mark the shipment as containing radioactive material. The event resulted in the filing of a Hazardous Material Incident Report in accordance with DOT requirements. (NRC Event Notification Report 41875)

These events highlight the importance of ensuring that hazardous, contaminated, or classified material is not released to the general public through property sales. Organizations responsible for processing excess material need to make certain that material, equipment, and property are adequately surveyed for contamination, screened for hazardous materials, and appropriately marked or tagged to indicate whether it has been cleared for release or is to be held pending survey and sample results. Equipment location and operational history should also be considered in the screening process. Both personnel involved in D&D activities and shippers need to be aware of the proper methods of sending material to the excess facility and must comply with appropriate procedures. Ongoing D&D work and facility closure projects throughout the DOE Complex will continue to provide a steady stream of excessed materials, thus underscoring the necessity to properly screen and exclude undesirables in order to protect the public.

KEYWORDS: *Excess material, surplus, salvage, explosive, radioactive material, property sale, public*

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

4. WORKING SAFELY OUTSIDE THE WORKPLACE — PART I: ELECTRICAL WORK

As headlines grimly remind us, emphasis on worker safety cannot be ignored or left behind when we leave work at the end of the day. Four deaths at the recent National Scout Jamboree underscore the importance of using safe work practices at all times. Four Scout leaders at the Jamboree were electrocuted when the center tent pole they were helping a contractor set up hit a power line. An Army investigation into the accident is ongoing, and neither the Army nor the Boy Scouts of America has issued a detailed account.

To provide shelter and shade for their Scouts' meals and meetings, and to avoid shipping a huge tent from Alaska to Virginia, the Alaska Scout contingent hired a local contractor to erect a rented 40-foot by 40-foot tent. Investigators learned that the tent rental contractors asked Scout leaders for help erecting the center pole beneath the canopy. Both the contractors and leaders were inside the tent handling the pole, which protruded through an opening in the top. Suddenly there was a sound like fireworks, a buzzing, and a flash of light as the pole hit an outside power line, which those inside the tent had not been able to see. When utility workers later arrived at the scene and cut power, the rescue workers retrieved the bodies of the four Scout leaders. Three others, including two tent contractors, were injured.

As extraordinary as this event seems, its tragic components can be seen in tasks we perform at home and while vacationing: lack of situational awareness, failure to canvass the surrounding area, lack of planning, and jumping in to help or get the job done. When we work at home we desire independence, think "it can't happen to us," neglect to use PPE, and take shortcuts. In places we consider safe havens — at home or in a Scout camp among friends and peers, for example — we may forget the rules that have kept us safe at work.

Three recent DOE Complex events underscore the importance of situational awareness and taking appropriate precautions when working around electrical components.
On June 3, 2005, a dump truck driver at the Moab Site Project struck and severed electrical power lines while attempting to deposit backfill as part of an environmental remediation project. The operator believed he was skilled enough to maneuver the truck and its bed under the power lines without striking them, although he had been specifically instructed not to pass under the lines. (ORPS Report ID--MCTC-GJPOTAR-2005-0001) Overconfidence, like that displayed by the truck driver, can be especially dangerous when working near power lines at home, where there may not be medical help or an experienced co-worker to help if there is an emergency.

On March 18, 2005, a crane operator traveling an authorized route between two Hanford work sites became distracted by his non-functioning radio and neglected to "knuckle down" (i.e., lower the boom) when he went under communication lines. The truck snagged and broke the lines. The authorized route had recently been changed, bringing equipment into proximity with overhead lines. The driver should have communicated his intent to his supervisors. If he had, either the ensuing discussion and review or being told to use a spotter might have prevented the event. ORPS Report RL--PHMC-SOLIDWASTE-2005-0001) This event illustrates why changed scope or conditions demand that you reevaluate the job and consider "what if?".

On November 10, 2004, at the Portsmouth Gaseous Diffusion Plant, an excavator came in close proximity to a 13.8-Kv power line, resulting in a power outage to two pump and treat facilities, two environmental stations, a construction trailer, and a traffic light. A spotter stopped the operator when he heard a popping sound from the overhead line, which may have prevented a fatality. (ORPS Report ORPP-PPPO-UDS-PORTDUCON-2004-0001)

The Portsmouth event illustrates that you do not have to actually contact a power line to cause an arc or sustain a fatality. When the voltage is high enough, electrons are attracted to ground with sufficient energy to ionize air. This discharge into the surrounding atmosphere from a high voltage source produces what is known as a corona effect — sparks or the corona of light — and can be powerful enough to tear apart insulating material and make it conduct electricity. That is why high power lines are so dangerous: a fatality can result not only from touching them, as at the Scouting Jamboree, but also by being in close proximity to them.

Take Electrical Safety Home

At work, supervisors, safety managers, and industrial safety staff act as backup or a conscience, and procedures and work packages guide electrical work steps. But when we arrive at home, we are both boss and workforce, solely responsible for our safety and that of the people around us.

Plan Your Work and Allow Sufficient Time

Allow enough time to plan your work and complete it without rushing or taking shortcuts. Start by gathering the correct tools and PPE, such as safety glasses, protective gloves, and closed-toe shoes or boots, and by checking everything for operability. Make sure to lock out the breaker or fuse box so no one can turn the power on while you're working.

Look Up and Down

Check for overhead hazards such as power lines, especially those connected to the house, and for hazards underfoot such as trailing power tool cords, standing water, and sharp edges that can damage electrical cords. When working near electrical lines or equipment, use a wood or fiberglass ladder and have someone "spot" for you.

In General

If you plan to dig, contact a local underground utility locator — this is usually a free service. Make sure outdoor electrical outlets are equipped with ground fault circuit interrupters. Inspect power tools and their cords for wear and tear; replace them if cords are frayed or cut. Ensure that effective safety guards are in place and that extension cords have adequate capacity for the tools in use.

DON'T WORK IF YOU'RE TIRED OR SICK — IT'S NOT WORTH THE RISK.

Know When to Issue a Stop-Work Order — Your Own

Stopping work when you have doubts about its safety is a responsibility all DOE workers share. But knowing when to stop work at home may be more difficult. When things aren't going right (e.g., if the extension cord is too short or you don't have someone to spot for you near power lines), **stop work**. Hire a professional to do work that involves electrical wiring of power sources with which you are unfamiliar. Your safety is worth the extra time and money.

Home projects should be performed with the same thorough planning and thoughtful, step-by-step execution used at DOE worksites. There, programs are in place to help ensure workers go home each night in the same safe condition they arrived. Workers owe it to themselves, their families, and their employers to perform work safely, whether at work, at home, or at a recreation site.

KEYWORDS: *Electrical, power line, near miss*

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

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
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
MSDS	Material Safety Data Sheet
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control