Office of Environment, Safety and Health • U.S. Department of Energy • Washington, DC 20585

OPERATING EXPERIENCE SUMMARY

Office of Environment, Safety and Health

OE Summary 2002-16

August 12, 2002

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, time permitting, 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.

The OE Summary can be used as a DOE-wide information source as described in Section 5.1.2, DOE-STD-7501-99, ***The DOE Corporate Lessons Learned Program***. Readers are cautioned that review of the Summary should not be a substitute for a thorough review of the interim and final occurrence reports.

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EVENTS

1. EXOTHERMIC METAL REACTION DURING CONVERTER DISASSEMBLY

On June 27, 2002, at the East Tennessee Technology Park, an exothermic reaction (metal fire) occurred during disassembly of a gaseous diffusion converter using a plasma arc torch. No injuries or release to the environment resulted from this occurrence. (ORPS Report ORO--BNFL-K33-2002-0005)

The exothermic metal reaction occurred in the converter tube bundle as a result of contact with hot metal while cutting a bracket during disassembly. When the hot metal contacted the tube bundle, it caused a reaction that is self-propagating and does not require oxygen from the air (Class D metal fire). When the workers discovered the reaction in the tube bundle they attempted to extinguish it with an ABC dry chemical extinguisher, which had no effect. Contrary to the work instructions that required the workers to evacuate the area, they stayed and extracted the tube bundle from the converter shell in an effort to get the fire suppression agent more directly in contact with the reacting metal They attempted to break apart the reacting metal with shovels and apply a CO_2 extinguisher, which was also ineffective. Extracting the tube bundle caused it to come in contact with a flame-retardant (but still flammable) security curtain.

The foreman arrived on the scene, ordered an evacuation of the workshop area, and pulled the fire alarm. After the evacuation, two overhead sprinklers discharged because the security curtain had caught fire from contact with the reacting tube bundle. When the firefighters arrived, they secured the sprinklers because they were not contributing to extinguishing the metal reaction. Power was secured to a portion of the facility because the sprinkler water runoff threatened electrical equipment. The firefighters extinguished the reaction with a Class D metal fire suppression agent called Met-L-X®.

Two previous exothermic metal reactions had occurred during the contractor's disassembly operations, which were reported in OE Summaries 2001-02 and 2001-07. The first occurred on April 4, 2000, after a field change notice was completed to the work instructions that allowed plasma-torch cutting on the tube bundle sheet. The second fire occurred on July 25, 2001, during *in-situ* disassembly operations in which the cutter angled the plasma-arc torch in the direction of the tube bundle contrary to the work instructions.

A Type B accident investigation was conducted from July 1 through July 19. The investigation board concluded that the accident was preventable, and that if the contractor's management systems and processes had implemented the corrective actions from the previous two events, the consequences from this accident scenario would have been mitigated. The board published its report, *Type B Accident Investigation, Exothermic Metal Reaction Event During Converter Disassembly in Building K-33 at the East Tennessee Technology Park on June 27, 2002* (DOE/ORO-2132, July 2002).

This event illustrates that delays in corrective actions can result in recurrence of the same or similar event without any mitigation in the consequences. Prioritization of corrective actions and closure schedules should be reviewed periodically. Also, inappropriate worker responses to emergencies can lead to making an accident more severe, putting workers at risk. Drills, exercises, and training must be realistic if workers are to respond appropriately to emergencies. Metal fire suppression agents should be readily available in situations where metal fires are possible.

KEYWORDS: *D&D, corrective actions, exothermic, tube bundle, metal fire*

ISM CORE FUNCTIONS: *Analyze the Hazards, Develop and Implement Hazard Controls, Provide Feedback and Continuous Improvement*

2. NEAR MISS TO PERSONNEL INJURY WHEN A JIB CRANE FALLS

On May 15, 2002, at the Los Alamos National Laboratory, a jib crane weighing approximately 900 pounds (Figure 2-1) fell off a lift gate of a box truck and landed on a loading dock, spilling some hydraulic fluid. Workers were lowering the lift gate when the crane shifted and fell. One of the workers received a minor injury that did not require medical attention. (ORPS Report ALO-LA-LANL-HEMACHPRES-2002-0001)

Figure 2-1. Jib crane

Five workers were loading the jib crane onto a box truck with a lift gate rated for a maximum weight of 1,200 pounds. The crane was to be transported to general excess salvage. In the absence of a procedure for this task, the workers were performing the lift using “skill-of-the-craft,” and were unaware that the crane contained lead counterweights. The jib crane did not have a weight label, so the workers estimated the crane to weigh between 800 and 1,000 pounds.

During the lift, the workers realized that the crane could not fit in the box of the truck and they immediately began to lower the lift gate. As the gate was being lowered, the crane shifted toward a worker who was steadying the crane while standing in front of the lift gate. The worker jumped to the side and hit the sacrum area of his back on a handrail next to the staging area as the crane fell onto the dock where the worker had been standing. The other four workers were standing clear of the area at the time of the incident.

The direct and root causes of this event were identified as personnel error because the workers did not follow the site’s property disposal procedure. This procedure stipulates that if a two-person team cannot safely load an item, a forklift must be used to load it.

There have been a number of lifting events across the DOE complex over the past year. For example, an article in Operating Experience Summary issue 2002-01 described how a 1,500-pound shipping container lid was inadvertently knocked over during a lifting operation, resulting in a near miss to an injury. (ORPS Report CH-PA-PPPL-PPPL-2001-0006)

These occurrences illustrate the importance of analyzing the hazards and developing and implementing hazard controls before beginning work. The workers should have used a forklift to load the crane onto a vehicle large enough to hold the crane. Before this lift began, the workers should have determined if the crane would fit in the box of the truck and removed the lead counterweights from the crane.

KEYWORDS: *Lift, jib crane, near miss*

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

3. MECHANICAL LOCKOUT/ TAGOUT IMPROPERLY VERIFIED

On July 9, 2002, at the Hanford Site, a worker assigned to independently verify the position of a valve as part of a lockout/tagout installation was unable to verify the valve position because a locking device had been installed over the valve operator. Instead of stopping work and informing a supervisor, the worker assumed that the valve was in the correct position and signed the valve position verification paperwork, thus invalidating the required independent verification of the lockout/tagout. (ORPS Report RL--PHMC-SNF-2002-0043)

A lockout/tagout was installed on the demineralized water system at a Hanford facility in support of a work package. During the installation, the worker performing the verification verified that the component tag was correct and that the "Danger Do Not Operate" tag was installed on the correct component. However, the worker was unable to verify proper valve position, as required by the lock and tag administrative procedure, because a clamshell-type locking device had been installed on the valve operator, preventing the verifier from viewing the position of the handwheel or doing a hands-on check. The valve also did not have an installed position indicator.

The applicable procedure states that if the conditions specified in the procedure (e.g., valve position) cannot be verified, the worker is to stop work and notify the Shift Operations Manager so that appropriate remedial actions can be taken. The worker violated this procedural instruction and instead decided that verifying the installation of the locking device over the valve operator met the intent of the valve position verification requirements. By then attesting with his signature that the valve was in the proper position, the worker invalidated the independent verification process for the lockout/tagout.

The improper lockout/tagout was discovered when the DOE facility representative, conducting a surveillance review of lockout/tagouts at the facility, observed the failure to adequately perform independent verification and notified facility management. The worker assigned to perform the independent verification had not reported any problems with the verification to supervisory personnel.

DOE policies and good practices on independent verification can be found in DOE-STD-1036-93, *Guide to Good Practices for Independent Verification* (URL http://tis.eh.doe.gov/techstds/standard/std1036/s1036cn1.pdf). Section 4.2.1, "Removing Equipment from Service," states that independent verification should always be performed after installation of a lockout/tagout to ensure that adequate protection for workers is provided, as described in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts* (URL http://tis.eh.doe.gov/techstds/standard/std1030/std1030.pdf). Additional information on this safety practice can be found in DOE Safety Notice 95-02, *Independent Verification and Self-Checking* (URL http://tis.eh.doe.gov/web/oeaf/lessons_learned/ons/sn9502.html).

A search of the ORPS database revealed 13 lockout/tagout events at seven different DOE sites during the first seven months of 2002. These events included failure to lock out or tag out electrical components before working on them, failure to isolate all energy sources to an electrical component being worked on, and various types of procedural violations.

This event underscores the fact that independent verification is a very important factor in providing safety assurance at DOE facilities and operations. Vigorous and aggressive independent verifications ensure that errors are caught before they manifest themselves in accidents, and represent a key element of any successful safety assurance program.

KEYWORDS: *Independent verification, lockout/ tagout, procedure violation*

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

4. WORKERS CUT PRESSURIZED INSTRUMENT AIR LINE

On June 6, 2002, at the Rocky Flats Environmental Technology Site, construction workers cut through a pressurized instrument air line thought to be depressurized and isolated. When they realized they had cut a pressurized line, the workers immediately stopped work. The workers were performing deactivation and decommissioning (D&D) work associated with asbestos abatement on the roof of a building. All the electrical power to the building had been previously disconnected and it was assumed that when facility maintenance personnel locked out the argon, nitrogen, fluorine, steam condensate and water lines that the instrument air line was also locked out. No one was injured. (ORPS Report RFO--KHLL-371OPS-2002-0029, final report filed June 24, 2002)

The construction workers had contacted the construction superintendent for permission to cut the instrument air line, which was located along the outside of the building roof. The air line was an obstruction to their asbestos abatement work and it had to be cleared. Construction management personnel reviewed the situation and assumed that building maintenance personnel had isolated the instrument air line through a lockout/tagout, placing the equipment in a safe configuration. Based on this assumption the construction superintendent gave permission for the workers to cut the instrument air line. The workers used a portable electric saw to cut through the air line, which was pressurized to approximately 100 pounds per square inch, gauge.

The direct and root cause of this event was personnel error (inattention to detail) because of the failure to walk down the instrument air system to verify isolation and the failure to check the work package for sign off signatures that verified the instrument air line was isolated and depressurized. A review of the work package, after the line was cut, indicated that the isolation verification step in the work package had not been signed off. Had the work package been reviewed (attention to detail), it would have been recognized that the instrument air line had not been secured and this was a future step to be performed in the work package.

One of the corrective actions from this event is to train personnel on ensuring verification of equipment status and verification of work steps in the work package. Specifically, supervisors will be trained to verify every isolation point and to know the requirements of the work package.

Another D&D event occurred at Rocky Flats on July 8, 2002, when workers accidentally cut a conduit containing a 120-volt energized line with a power saw. The cutting of the conduit and hitting the energized line caused a small spark, but did not trip a circuit breaker. The workers were not wearing required protective equipment, but no injuries occurred. The line was de-energized, and a lockout/tagout was placed on the power source. (ORPS Report RFO--KHLL-371OPS-2002-0039)

The workers were performing D&D activities that included cutting conduit. All identified wires in the conduit were checked for voltage and verified to be de-energized. However, an additional energized wire entered the conduit through a "T" connection that was not visible at the conduit ends. The “T” connection was located about 15 feet above the floor and over some ducting, and this additional energized wire was not identified.

Investigators determined that the workers did not follow prescribed procedures per the site manual that direct them to wear PPE appropriate for an expected voltage. The manual requires PPE as if all lines being cut could be energized. The building D&D electrical work was curtailed pending training and review/correction of the work package.

These events underscore the importance of constantly reviewing work documentation to ensure work practices will be followed before starting work and continued to be followed through completion of the work. A review of the work package would have shown that the instrument air line had not been isolated, thus preventing this event.

KEYWORDS: *Cut pressurized line, work package, lockout/tagout, instrument air, cut conduit*

ISM CORE FUNCTION: *Perform Work within Controls*

5. FALL FROM LADDER CAUSES INJURY

On June 18, 2002, at the Stanford Linear Accelerator Center (SLAC), a subcontractor worker was preparing to paint a jib crane when he fell from a 16-foot extension ladder (Figure 5-1) and suffered a compound fracture of his left elbow and hematoma of his right knee. (ORPS Report OAK--SU-SLAC-2002-0004; final report filed July 12, 2002)

Figure 5-1. The accident scene

The worker placed the top rails of the extension ladder onto the midsection of the crane's boom. The boom was in a full electric stop position next to the wall. As he climbed the ladder, the force of his weight caused the boom to rotate toward the wall. The rails of the ladder slid off the boom, and the ladder fell towards the ground, striking the wall. The worker slid down the ladder approximately 4 feet and fell 6½ feet to the ground.

A SLAC employee found the worker lying on the ground shortly afterward and called for emergency assistance. The injured worker was transported to a hospital, where he was treated for his injuries and released two days later.

Results of the subsequent investigation revealed that ladder safety training had not been provided to the worker that was injured.

The site engineering and maintenance department conducted a general safety meeting to discuss ladder safety. In addition, the purchasing department is in the process of evaluating the existence of safety training programs for "job-shopper" subcontractor organizations.

29 CFR 1910, Subpart D, *Walking-Working Surfaces,* requires that a portable ladder "shall be so placed as to prevent slipping, or it shall be lashed, or held in position." In this case, the site believes the ladder should have been extended so as to have a three-rung clearance over the top of the beam.

A search of the Occurrence Reporting and Processing System yielded several injuries due to falls from ladders, but none occurred from improperly secured ladders, nor were any events identified involving a lack of ladder safety training.

This occurrence illustrates that workers should receive ladder safety training appropriate to the type of ladder they will be using. In addition, ladders need to be properly extended and secured before workers attempt to ascend them.

KEYWORDS: *Ladder safety, fall, injury*

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

SAFETY WARNING

Static Electricity Can Cause Fires During Vehicle Refueling

The Petroleum Equipment Institute warns motorists to be cautious of static electricity at gasoline pumps, which can cause a fire and result in serious injury and property damage. While the Institute continues to collect data on accidents, it appears that static electricity is most often generated when motorists re-enter their vehicles while refueling. Friction against the seat generates a static charge, which discharges when they touch the gasoline pump nozzle, causing a spark and igniting fuel vapors around the nozzle. Studies indicate these accidents occur mostly during the winter season in cold, dry climate conditions. The Institute has documented more than 150 incidents of static ignition at fuel pumps nationwide, with more than half reported since 1999. It is estimated, however, that there are hundreds of unreported incidents each year.

The Petroleum Equipment Institute is an international trade association for distributors, manufacturers, and installers of equipment used in petroleum marketing and liquid-handling operations, as well as operations and engineering personnel from the petroleum marketing industry. More information about how static electricity can cause fires at the gas pump can be obtained from the Institute's website at http://www.pei.org/static/.

Figure 2. Burned gasoline pump

Out of an estimated 16 to 18 billion fuelings a year in the United States, most are safe nonevents that pose no danger to consumers. Most of the reported fires have been flash fires with little damage and minimal injuries, and most have occurred at pumps that have no vapor recovery. Motorists need to be aware of the potential that re-entering their car will create static electricity that can cause a fire. Figure 1 shows a vehicle damaged in a refueling fire, and Figure 2 shows a burned gasoline pump.

Figure 1. Vehicle burned by refueling fire

The following events were reported in the ESD Journal™, a trade journal on issues of electrostatic discharge, which can be accessed at http://www.esdjournal.com/.

- In Boise, ID, a woman was refueling her vehicle and got back inside to write a check. When the automatic nozzle shut off, she got out of the vehicle to finish refueling. When she touched the nozzle, static electricity buildup discharged, igniting the fumes in the nozzle and fill pipe area. She was able to remove the nozzle and extinguish the flames.
- In Tucson, AZ, a man was treated for first- and second-degree burns on his shoulder, buttock, and leg after his car and the gasoline pump were destroyed in a fire. The man started filling the car and then re-entered the driver's side to fill out a logbook. When the nozzle clicked off, he got out of the car, and, as he removed the nozzle, the fueling port ignited.
- Near Asheville, NC, a 12-year-old girl received

burns to her hands and left leg when she got out of the car to remove the pump nozzle. When she pulled the nozzle from the tank she saw a spark, which ignited the gasoline.

In addition to static discharge from people, fires have occurred while filling gasoline containers in the back of a car on the carpet or filling containers in the back of a lined truck bed. Static electricity builds up on the container and then discharges to the nozzle, igniting a fire. Another source of static discharge has been tied to cellular telephone use. Although debated as to whether cell phone use has caused fires at the gas pump, the Mine Safety and Health Administration (MSHA) issued a safety alert on this potential hazard after an offshore drilling rig worker received second-degree burns when he answered his cell phone in an area containing an explosive mixture of gas. The alert, which recommends turning off mobile phones before entering areas such as fueling areas, gas stations, chemical and fuel storage areas, or anywhere potential explosive atmospheres exist, can be obtained at http://www.msha.gov/alerts/potentialcell.htm.

Other organizations within the petroleum industry are aware of this problem; for example, the American Petroleum Institute has implemented a public awareness campaign to warn and educate the public on the potential hazards of static electricity at the fueling point. Some distributors have revised warning labels and placards and are installing them on gasoline pumps. Figure 3 shows a revised placard that includes hazard warnings for static electricity and electronic devices.

The lesson learned from this issue is that static electric discharge near gasoline pump nozzles can ignite vapors near the fill port and cause serious fires. People pumping gas should avoid re-entering the vehicle while refueling. If they must re-enter the vehicle, they should touch a metal part of the vehicle located away from the fill port before touching the nozzle to discharge the static electricity. When filling gasoline containers, remove the container from the vehicle and place it on the ground before filling. In addition, avoid using cellular telephones or other electronic devices while pumping gas or when near potentially explosive atmospheres.

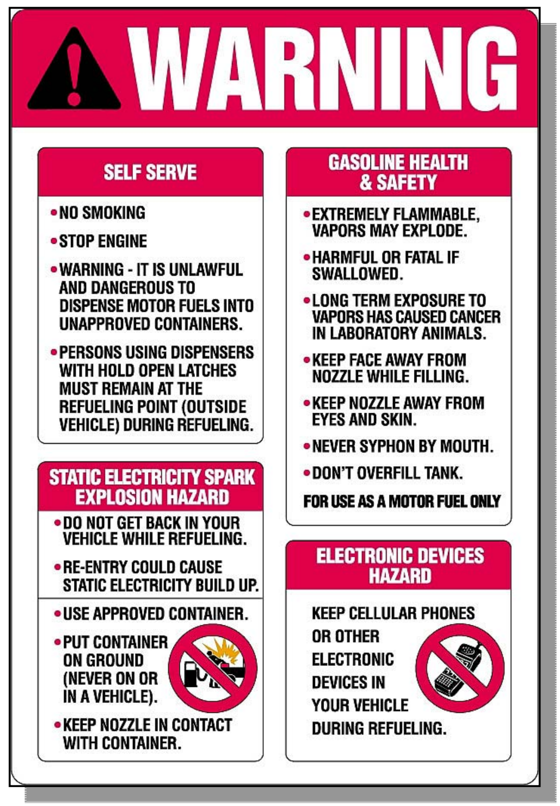

Figure 3. Revised warning placard