OPERATING EXPERIENCE SUMMARY

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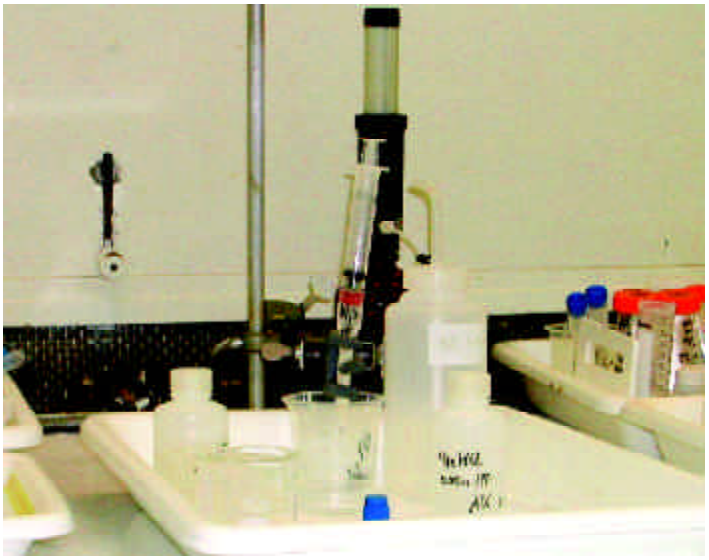

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With the full implementation of the redesigned Occurrence Reporting and Processing System (ORPS) on December 1, 2003, the Occurrence Reporting Binning and Tracking Tool (ORBITT) database has been discontinued. The ORPS database includes HQ Keywords that are equivalent to ORBITT bins to assist users in sorting through events to perform specific searches.

The old ORBITT bins have been crosswalked to the new HQ Keywords to provide data continuity.

Users may direct questions to Bal Mahajan by e-mail at bal.mahajan@eh.doe.gov.

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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.

EVENTS

1. SEALED DRUM PRESSURIZED BY CHANGE IN ALTITUDE

On January 9, 2004, at the Argonne National Laboratory – West receiving warehouse, the lid on a sealed drum (Figure 1-1) unexpectedly popped up while a material handling worker was opening the drum. The drum, which contained loose activated charcoal, had been received from a California manufacturer. The internal pressure was sufficient to raise the lid about 2 inches and disperse the granular charcoal in a 4-foot-diameter circle when the worker loosened the retaining ring on the drum lid. The worker was not injured and only a few ounces of material were released. (ORPS Report CH-AA-ANLW-ANLW-2004-0002)

There was no packing slip identifying the contents of the 55-gallon drum when it was received from the manufacturer. The material handler suspected that the packing slip was inside the drum and decided to open it and check. Based on his knowledge of previous shipments by this vendor, the worker believed that the drum contained activated charcoal in bags, rather than in bulk form without secondary packaging; however, the worker did not verify the contents before he attempted to open the drum.

Figure 1-1. Drum containing activated charcoal

Investigators suspect that the pressure in the drum resulted from the drum being loaded at sea level and being opened at an elevation of approximately 5,100 feet.

Workers need to be aware of the potential for containers to become pressurized because of a change in altitude. Similar events have occurred at other DOE sites.

On January 28, 1999, at the Los Alamos National Laboratory, shipping/receiving employees were opening empty 55-gallon drums at the Plutonium and Processing Facility when the lid of one drum was forcibly ejected. The empty drums had been sealed and shipped from Oak Ridge (where the elevation is approximately sea level) to Los Alamos (elevation 7,200 feet). The change in altitude caused the pressure in the drum to build up to approximately 3 psig. (ORPS Report ALO-LA-LANL-TA55-1999-0006)

The workers' supervisor recalled a similar event at Los Alamos several years before that also involved empty 55-gallon drums that had been sealed at a lower elevation. In response to that event, facility personnel had obtained a safety device to restrain the drum lid and allow internal air pressure to escape slowly before the lid was removed.

On May 17, 1995, at Grand Junction, the lid on a new 55-gallon drum blew off when a technician attempted to remove it. As in the Los Alamos events, investigators believed differing ambient conditions between the location where the drum was sealed and the location where the drum was opened caused the pressurization. (SELLS Identifier Y-1995-OR-DOEGJPO-0601)

In addition to changes in altitude, sealed drums can become pressurized from exposure to the sun. On September 20, 2002, at the Rocky Flats Environmental Technology Site, the lid on an

GOOD PRACTICES

- Train material handlers and drum users on the possibility of drum pressurization from changes in altitude or environmental conditions (e.g., temperature).
- Treat all sealed drums, including new drums, as if they are pressurized until vented and proven otherwise.
- Provide instructions for safely venting drums that may be pressurized below the point at which they would bulge or otherwise deform.
- Use drum lid-restraining devices and harnesses.
- Develop drum handling procedures that address the need to vent new drums before use and describe a safe method for doing so.

empty 110-gallon overpack drum flew 3 feet into the air and struck an adjacent forklift. Waste management operators were preparing the drum for use when the incident occurred. The drum had been staged in the sun. Operators were directed to use lid restraining devices. (ORPS Report RFO--KHLL-WSTMGTOPS-2002-0022)

An Operating Experience Summary article published in Issue 2003-21 discusses pressurized drum events and includes photographs of restraining devices that can be used to prevent the lid on a pressurized drum from becoming a missile while personnel open and slowly vent the drum.

These events underscore the importance of recognizing the hazards that a pressurized drum presents to workers. Material handlers and drum users should approach, handle, and open all sealed drums as if they are pressurized.
Lid-restraining safety devices should be used routinely when opening closed drums. Personnel need to be aware that in addition to pressurization produced by chemical reactions within filled drums, empty drums can also become sufficiently pressurized to cause injury without any visible indications such as deformation or bulging.

KEYWORDS: *Pressurized drum, industrial safety, materials handling/storage, venting*

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

2. MULTIPLE FALL PROTECTION VIOLATIONS AT DEMOLITION PROJECT

In August and September 2003, at the Fernald Closure Project, five separate fall protection violations were recorded within a 5-week period. Some of these violations were the result of work organization and planning deficiencies and failure to follow the safe work plans developed for the demolition project. No injuries resulted from these occurrences. (ORPS Report OH-FN-FFI-FEMP-2003-0018; final report filed October 21, 2003)

The five violations included (1) working near the unprotected edge of the sixth floor (60-foot level) of a building being demolished, (2) working unprotected 12 feet above the ground, (3/4) failing to properly tie off fall protection harnesses (two instances), and (5) working near the unprotected edge of the fourth floor (40-foot level) of a building being demolished. Each of these violations is described below.

1. On August 13, 2003, a construction supervisor and a safety representative saw three subcontractor laborers working without fall protection within 4 to 5 feet of an unprotected edge on the sixth floor of a building being demolished. A subcontractor safety representative determined that adequate fall protection was not in place for the assigned work, which had not been approved.

2. On September 3, 2003, safety personnel saw a worker sitting on top of an asbestos containment structure, approximately 12 feet off the ground, without wearing fall protection. The worker had been standing on a scaffold, but stepped off it and sat on a pipe to pull a polyethylene cover up to complete the confinement enclosure.

3. On September 4, 2003, a facility representative watching a two-man team in an aerial lift install glove bags on steam and condensate pipes noticed that both workers wore full-body harnesses and lanyards, but one had the end of his lanyard clipped to his harness instead of to the ring on the mid-rail of the aerial lift basket as required by procedure.

4. On September 9, 2003, a construction support safety representative saw two workers in an aerial lift performing asbestos abatement work and noticed that one worker was not properly tied-off to the safety ring on the basket.

5. On September 15, 2003, a safety representative and a construction supervisor noticed a worker who was not wearing a personal fall arrest system near an unprotected edge on the fourth floor of a building. They walked to the other side of the building and saw two foremen installing a non-OSHA–compliant "Danger" tape 6 feet from the outer edge of the same floor to act as a "warning line" for workers. They directed all of the workers to exit the building.

Causal factors for these fall protection violations involved deficiencies in work organization and planning and inadequate enforcement of safety policies. A specific method for performing the work was not identified before work began and no one discussed implementing proper hazard controls with safety personnel. Supervisors failed to follow and enforce fall protection requirements even though the requirements were clearly established in the activity hazard analysis. Worker inattention, in the case of the workers who neglected to reconnect their lanyards to the anchor point of the aerial lift basket when they re-entered, was a contributing cause.

Corrective actions resulting from these fall protection violations included the following.

- Require a fall-protection competent person to inspect all above-grade work areas before allowing workers to enter them.

- Require all personnel working above ground level to have fall protection systems.

- Require all construction workers to attend a re-training session on fall protection requirements.

- Review all corrective actions from fall protection-related occurrence reports filed after January 2001 to ensure that these corrective actions are incorporated into plans and procedures for elevated work.

In addition, Fernald site managers declared a 1-day safety standdown in September 2003, largely as a result of these fall protection violations. During the standdown, site workers and supervisors received training on safety requirements, processes, and procedures (including those related to fall protection) to help improve their understanding and address safety compliance. However, three additional fall

FALL PROTECTION — CONTROL MEASURES AND GOOD PRACTICES

- Determine if any of the work can be performed at ground level by making adjustments in work execution provisions.

- Tether or otherwise restrain workers so they cannot reach an exposed edge of a floor or platform, thus eliminating the fall hazard.

- Use aerial lifts or elevated platforms for working surfaces instead of plates, beams, or pipes.

- Erect/use guardrail systems, warning lines, controlled access zones, personal fall arrest equipment, or safety nets to protect workers from falls.
- Designate one worker as a safety monitor to observe activities and alert workers to hazards that could cause a trip or fall.

- Establish a designated area or control zone where workers can perform their tasks when conventional fall protection systems are not feasible.

protection violations have been reported at the Fernald Environmental Management Project since September 15, 2003. The most recent violation occurred on January 9, 2004, when a drywall installation worker was observed on the upper deck of a mobile scaffold without fall protection

The fall protection deficiencies at Fernald violated several sections of the OSHA regulations in 29 CFR 1926, *Safety and Health Regulations for Construction,* Subpart L, *Scaffolds,* and Subpart M, *Fall Protection.*

APPLICABLE REQUIREMENTS OF SUBPART M, 29 CFR 1926.501(B)(1), *UNPROTECTED SIDES AND EDGES*

- Each employee on a walking/working surface with an unprotected side or edge which is 6 feet (1.8 meters) or more above a lower level shall be protected from falling by the use of guardrail systems, safety net systems, or personal fall arrest systems.
- The top edge height of top rails, or equivalent guardrail system members, shall be 42 inches (plus or minus 3 inches) above the working/walking level.

In the September 3, 2003, incident, the scaffold regulations in 29 CFR 1926 Subpart L no longer applied once the worker left the confines of the scaffold guard rail and climbed on top of the pipe. The worker should have had a system to protect against falls as required in 29 CFR 1926 Subpart M.

Falls account for the greatest number of fatalities in the construction industry each year. They result from a number of factors, including unstable work surfaces, not using or misusing fall protection equipment, and human error. OSHA reports that in 1995, 1,048 construction workers died on the job and 335 of the fatalities (32 percent) resulted from falls. Statistics for entire U. S. workforce, reported by the Bureau of Labor Statistics indicate that 670 fatalities and 96,359 injuries resulted from falls to a lower level in calendar year 2001. Studies have shown that the use of guardrails, fall arrest systems, safety nets, covers, and other devices can prevent many of the deaths and injuries that result from falls. OSHA regulations, statistics, and reports are available at www.osha.gov.

These events underscore the fact that some workers in the DOE complex do not give proper attention to following OSHA requirements for fall protection. Supervisors and foremen need to ensure that workers are informed of the hazards associated with falls before allowing work on top of structures or in elevated areas, and to enforce fall protection requirements at all times. Performing work at high elevations without fall protection compromises worker safety. OSHA reports that falls result in more than 30 percent of the fatalities associated with construction work, more than any other single cause.

KEYWORDS: *Fall protection, OSHA violations, construction/demolition safety, personal fall arrest systems, scaffold*

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

3. IMPROPER EYE PROTECTION RESULTS IN A NEAR MISS

According to the Bureau of Labor Statistics, about 1,000 eye injuries occur in American workplaces each day. The financial cost of these injuries is enormous — more than $300 million per year in lost production time, medical expenses, and workers' compensation. Wearing the wrong kind of eye protection for the job results in about 40 percent of workplace eye injuries, and many of these injuries occur because workers are wearing protective eyeglasses without side or full-face shields. This was the case in a near miss that occurred at a DOE facility.

On July 30, 2003, at Los Alamos National Laboratory, a post-doctoral employee narrowly escaped serious injury when approximately 1 milliliter of a hydrochloric/hydrofluoric acid solution sprayed over the top of his safety glasses and into his eyes. Co-workers quickly took him to an eyewash station and irrigated his eyes for

10 minutes. He was then transferred to Los Alamos Medical Center where his eyes were flushed with saline for an hour. Fortunately, the worker did not suffer any permanent eye damage. (ORPS Report ALO-LA-LANL-RADIOCHEM-2003-0015)

The worker had inserted a syringe into a slip-fit seal and attached it to a resin column in a custom-made arrangement to move the acid solution through the column (see Figure 3-1). He attached the empty syringe to the top of the column with a rubber ring to provide air pressure. Apparently, the seal was not adequately seated, and when he depressed the syringe plunger, acid sprayed out around the plastic seal and entered his eyes over the top of his safety glasses.

When the accident occurred, the worker was working in a fume hood and wearing the personnel protective equipment (PPE) required by the hazard control plan. This included a lab coat, two sets of latex gloves, booties, and safety glasses. The Material Safety Data Sheets for hydrochloric acid and hydrofluoric acid specify the use of either chemical goggles or a full-face shield, but neither was required in the hazard control plan.

Investigators determined that the PPE and fume hood did not provide an adequate level of protection for the hazards associated with the work being performed. They also determined that the hazard control plan was too generic in nature to provide adequate details regarding specific hazards and the necessary controls. The plan made no mention of the custom-made apparatus, relying on the worker's knowledge and expertise. The worker apparently did not question whether there might be additional hazards that should be considered before using the apparatus.

Figure 3-1. Syringe and column

A Los Alamos National Laboratory "Yellow Alert" about this event was distributed to DOE sites. The Alert included the following recommendations, based on a preliminary review of the occurrence.

- Managers and supervisors must ensure workers are equipped with proper PPE.
- The level of training provided to workers must be sufficient to enable them to recognize when controls and assistance are required.
- Workers can help protect themselves by performing their own hazard analysis and asking, "What can happen to me when performing this task?"

The LANL Yellow Alert is available at www.SAFTENG.net. A Lessons Learned report (SELLS Identifier LANL-TA55-2003-0001) is also available on the Society for Lessons Learned website at http://www.eh.doe.gov/ll/listdb.html.

Each eye, face, or face-and-eye protector is designed for a particular hazard, and the kind and degree of hazard should be considered when selecting appropriate protection. OSHA Standard, 29 CFR 1910.132, *Personal Protective Equipment*, requires suitable eye protectors to be provided where there is a potential for injury to the eyes or face from various hazards, including liquid chemicals, acids, or caustic liquids.

Eye and face protection also must comply with ANSI Z87.1-1989, *American National Standard Practice of Occupational and Educational Eye and Face Protection.* This standard states that goggles and face shields shall be used when there is a chemical splash hazard.

In addition, OSHA requires workers who must wear PPE to receive training in its use, including the correct type of PPE to be worn and when it is necessary to wear it. Additional information on

OSHA requirements can be accessed at www.OSHA.gov.

Personnel protective equipment is effective only if the correct equipment is selected based upon its intended use and if employees are trained in its use. Managers and supervisors must ensure that workers are equipped with the proper PPE and that physical barriers and administrative tools provide adequate protection. It is essential for workers, including those who are temporary or short-term employees (e.g., visiting researchers), to have a sufficient level of training to recognize when additional hazards may be present.

KEYWORDS: *Personal protective equipment, chemical hazards, injury*

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

REQUIREMENTS FOR EYE AND FACE PROTECTION — ANSI Z87.1-1989

- Wearers of contact lenses must wear appropriate eye and face protection devices in a hazardous environment.
- Side protectors shall be used when there is a hazard from flying objects.
- Goggles and face shields shall be used when there is a hazard from chemical splash.
- Face shields shall only be worn over primary eye protection (safety glasses or goggles).
- For employees who wear prescription lenses, eye protectors shall either incorporate the prescription in the design or fit properly over the prescription lenses.
- Protectors shall be marked to identify the manufacturer.
- Equipment fitted with appropriate filter lenses shall be used to protect against light radiation. Tinted and shaded lenses are not filter lenses unless they are marked or identified as such.

4. LOCKOUT/TAGOUT PROBLEMS TRACED TO NEED FOR A COMMON PROCEDURE

In the last 3 years, there have been more than 40 lockout/tagout (LO/TO) occurrences at the Hanford Site; 14 of them in fiscal year 2003. To address this issue, Fluor Hanford, Inc. (FHI), one of the principal Hanford contractors, decided to take the following actions.

- Develop a single LO/TO procedure that integrates established requirements and replaces approximately 14 individual facility/project-specific procedures.
- Revise and enhance the existing training program on LO/TO policies, processes, and procedures.
- Assess the knowledge and understanding of personnel involved in the LO/TO program.

FHI attempted to reverse the negative trend in LO/TO events identified in fiscal year 2002 by developing a single LO/TO process for servicing and maintenance, while keeping individual facility/project LO/TO procedures in place. Implementation required revising existing facility/project procedures to ensure there were no conflicts with the new process. However, even after implementing the new process, problems continued to occur.

For example, on May 19, 2003, a LO/TO violation occurred when workers replaced a vent line hose in an ion exchange module. Procedures directed workers to either lock out the inlet valves for the module before performing work or remove the inlet valve handles if it was not possible to apply locks. Because of personnel errors, neither action was taken, and no barrier protected the workers during the hose replacement. (ORPS Report RL--PHMC-SNF-2003-0019; final report filed September 26, 2003)

The subsequent critique revealed that all of the personnel involved exhibited a considerable lack of understanding of lockout/tagout procedures and identified discrepancies between the facility/project procedures and the FHI servicing and maintenance LO/TO process. FHI management quickly put compensatory actions in place to

COMMONLY MADE LOCKOUT/TAGOUT ERRORS

- Failing to include sufficient detail in work plans to identify requirements for lockout/tagout boundaries.
- Failing to thoroughly research and walk down a proposed lockout/tagout installation.
- Failing to perform self-checking of lockout/tagout application by installers and verifiers.
- Assuming a zero-energy condition exists without verification.
- Working outside the physical boundaries of a lockout/tagout.
- Departing from established lockout/ tagout practices or application points.
- Displaying inadequate training, complacency, inattention to detail, and over-reliance on skill-of-the-craft
- "Cutting corners" under pressure to meet schedules and deadlines
- Failing to invoke stop work authority when controls on hazardous energy sources are called into question

prevent additional occurrences while they continued to evaluate the extent of the problem across FHI projects.

These compensatory actions included assigning mentors to oversee the LO/TO practices at the K-Basins and other FHI-managed facilities and projects and to follow the process from planning through execution. This allowed work to proceed while uniform procedures were developed and implemented and helped prevent recurrence of LO/TO events. Concurrently, FHI staff developed a single procedure based on 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout / Tagout)*, and DOE Order 5480.19, *Conduct of Operations Requirements for DOE Facilities.* Staff from the DOE Richland field office worked with FHI to ensure a quality product that included the required enhancements to the LO/TO training program.

Examples of other Hanford events that indicated a need for a uniform process to implement LO/TO requirements, policies, and procedures include the following.

- On August 25, 2003, an electrician installing grounding posts for an electrical generator left the task unfinished while he left the area to obtain a part to complete the grounding connection. He did not lock and tag out the generator to indicate that the installation was incomplete. During his absence, a shift operations officer started the ungrounded generator. (RL--PHMC-GPP-2003-0003)

- On June 18, 2003, two crafts workers preparing to modify a monorail mistakenly placed their personal locks on the wrong circuit breaker, creating a potential for personnel injury. (RL--PHMC-SNF-2003-0023)

- On May 19, 2002, electricians removing a set of electrical receptacles failed to install a lockout/tagout and did not perform a zero energy check on the circuit before starting work. Despite specific instructions about which circuits were to be removed, the electricians deviated from the work package and cut wires on an energized receptacle circuit. (RL--PHMC-SNF-2002-0030)

- On July 17, 2001, workers improperly removed a conveyor guide bar that interfered with a port glove without obtaining approval for this modification. Removal of the guide bar exposed workers to a rotating equipment hazard. Administrative controls required electrical isolation of the conveyor and the required lockout/tagout was not performed. (RL--PHMC-PFP-2001-0031)

Regulations and guidance on LO/TO issues can be found in 29 CFR 1910.147, *The Control of Hazardous Energy (Lockout / Tagout)*, and related fact sheets and booklets. These documents can be accessed at www.osha-slc.gov/SLTC/control-hazardousenergy. DOE guidance on this topic can be found in DOE-STD-1030-96, *Guide to Good Practices for Lockouts and Tagouts,* which is available at http:/www.eh.doe.gov/techstds.

A discussion of the characteristics and frequency of LO/TO events in the DOE complex in the first 3 months of 2003 is presented in the Operating Experience Summary article *Lockout/Tagout Violations and Lessons Learned* (OES 2003-06).

The events at Hanford underscore the importance of providing the requisite amount of knowledge, training, testing, and hands-on experience to ensure that crafts and supervisory personnel involved in LO/TO activities fully understand and implement the associated requirements, policies, and procedures. Safety assurance can be provided only if effective hazard controls are provided, workers and supervisors are rigorously trained on these controls and the reasons for them, and the work is performed within these established controls.

KEYWORDS: *Lockout/tagout, procedure violations, training needs, hazardous energy, hazard controls, human error, management errors*

ISM CORE FUNCTIONS: *Develop and Implement Hazard Controls, Perform Work within Controls, Provide Feedback and Continuous Improvement*

The following is a list of acronyms and abbreviations frequently used in the Operating Experience Summary.

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	Radiation 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