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 recently began publishing a series of "Just-In-Time" reports. These two-page reports inform work planners and workers about specific safety issues related to work they are about to perform. The format of the Just-In-Time reports was adapted from the highly successful format used by the Institute of Nuclear Power Operations (INPO). Each report presents brief examples of problems and mistakes actually encountered in reported cases, then presents points to consider to help avoid such pitfalls.

1. Deficiencies in identification and control of electrical hazards during excavation have resulted in hazardous working conditions.
2. Deficiencies in work planning and hazards identification have resulted in electrical near misses when performing blind penetrations and core drilling.
3. Working near energized circuits has resulted in electrical near misses.
4. Deficiencies in control and identification of electrical hazards during facility demolition have resulted in hazardous working conditions.
5. Electrical wiring mistakes have resulted in electrical shocks and near misses.
6. Deficiencies in planning and use of spotters contributed to vehicles striking overhead power lines.

The first six Just-in-Time reports were prepared as part of the 2004 Electrical Safety Campaign. In April, the Office of Environment, Safety and Health published a Special Report on Electrical Safety. The purpose of this report is to describe commonly made electrical safety errors and to identify lessons learned and specific actions that should be taken to prevent similar occurrences. This report can be accessed at http://www.eh.doe.gov/paa/reports/Electrical_Safety_Report-Final.pdf.

EH plans to issue more Just-in-Times soon on other safety issues, such as lockout and tagout, fall protection, and freeze protection. All of the Just-in-Times can be accessed at http://www.eh.doe.gov/paa/jit.html.

EVENTS

1. NEAR MISS — CARPENTER CUTS PRESSURIZED NITROGEN LINE

On August 31, 2004, at the Savannah River H-Tank Farm, a carpenter accidentally cut into a pressurized nitrogen line, resulting in the uncontrolled release of 110 psig nitrogen to the atmosphere. The carpenter was using an electric circular saw to cut planks for walkboards on a scaffold. He had placed the plank on top of the nitrogen line while making the cut. There were no injuries. (ORPS Report SR--WSRC-HTANK-2004-0029)

Carpenters were erecting scaffolding in the Cold Feeds area. The carpenter was about 12 feet up on the scaffold and was wearing a safety harness. The 1-inch copper nitrogen line was a branch line off a larger header of the normal nitrogen system. The nitrogen lines were clearly marked and the existence of the 1-inch line was discussed during the pre-job brief. Figure 1-1 shows the location of the line, which ran approximately 6 inches above the wood flooring of the scaffolding.

Although the carpenter knew about the line, he rested the board on top of it while cutting the wooden plank for the scaffolding installation. When the carpenter cut the board, the saw blade also cut almost all the way through the 1-inch line (Figure 1-2).

Operators in the control room were notified of the breached nitrogen line and dispatched an operator to identify and close an isolation valve in the nitrogen system. After he isolated the nitrogen line, the operator locked and tagged the isolation valve closed.

Investigators determined that the carpenter should have been able to see the nitrogen line because it was in plain sight and that he knew the line was there because it had been discussed during the pre-job brief. Investigators also learned that the instructions for erecting the scaffold required all saw cuts to be performed on the ground, not up on the scaffold.

Figure 1-1. Scaffold and nitrogen line

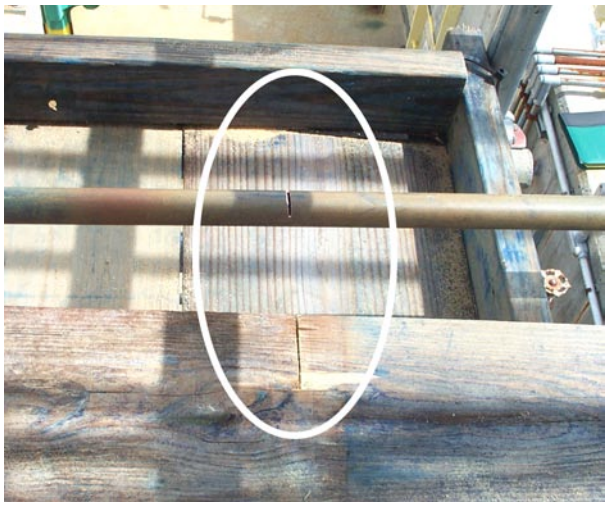

Figure 1-2. Saw cut in line and plank

This event underscores the importance of adhering to work instructions and following the information provided during pre-job briefings. Workers need to maintain awareness of their surroundings at all times and remain focused on the task at hand, particularly when using powered hand tools. This event was a near miss because of the sudden high-velocity release of nitrogen near the carpenter, and it could have been even more dangerous if the nitrogen line had been a conduit containing energized electrical conductors.

KEYWORDS: *Saw, cut, pipe, pressurized, nitrogen, near miss*

ISM CORE FUNCTION: *Perform Work within Controls*

2. EXPECT ASBESTOS IN RENOVATION AND D&D ACTIVITIES

The Occupational Safety and Health Administration (OSHA) estimates that 1.3 million employees in construction and general industry face significant asbestos exposure on the job, with the heaviest exposures likely to occur during renovation or demolition. Although asbestos is recognized as a health hazard and is now highly regulated, opportunities for exposure exist when D&D activities take place in aging facilities where the presence of the material may not be well known.

Such was the case on August 23, 2004, at Sandia National Laboratories, when workers were exposed to material containing 35 percent asbestos while removing cooling tower fill from three towers. (Figure 2-1 shows one of the towers and fill material.) The towers, manufactured in 1979 to fire-resistant specifications, were out of service for 15 years but are now being brought back into service to reduce energy costs. Facilities Management and Operations Center staff believed that the fill material was constructed of polyvinyl chloride (PVC), not transite or asbestos-containing materials (ACM). Because PVC and fire-resistant cooling tower fill are outwardly identical, and based on general material knowledge, no one ordered additional testing, nor was work planned or performed with controls associated with an asbestos abatement activity. (ORPS Report ALO-KO-SNL-NMFAC-2004-0005)

After the regular shift structural crew removed fill material and loaded it for disposal, a mechanical craftsperson on the swing shift noticed fibers on the ground and called his supervisor to report that the material might contain asbestos. Particles were immediately sent for testing. The mechanical supervisor made a stop-work call to the structural supervisor's work phone; however, no call was made to his home. When the structural supervisor received the message at work the

Figure 2-1. Cooling tower and fill material

next morning, he stopped the fill removal work. However, it was too late to stop the dump truck driver, who had already made his early morning delivery to the Kirtland Air Force Base (AFB) landfill.

Test results (received in less than 4 hours) showed that the fill material was 35 percent asbestos. All parties, including Kirtland AFB, the National Nuclear Security Administration (NNSA), contractors, and craftspeople associated with the project were notified; and workers associated with the retrofit project were directed to go to the site medical facility for evaluation.

The sole method for determining and quantifying the extent of asbestos exposure is breathing zone air monitoring, which must be in place when the work is actually performed. There is no method to extrapolate exposure from abatement cleanup activities to the personnel who handled and removed the tower fill material.

Workers had removed about 30 cubic feet of asbestos from the tower at the time the ACM was discovered. Landfill personnel determined that the material had not been attached to any framework and had been covered with dirt and debris, so it was not recoverable. Kirtland management reported the event to the New Mexico Environmental Department. Although non-asbestos PVC insulation and the tower fill insulation looked identical, a more conservative approach of sampling it "just to make sure" might have prevented the subsequent work shutdowns and notifications.

DOE management is concerned with both ACM and presumed ACM, or PACM. In 29 CFR 1926.1101, *Toxic and Hazardous Substances*, OSHA defines ACM as "any material containing more than 1 percent asbestos," and PACM as "thermal system insulation and surfacing material found in buildings constructed no later than 1980." Because the DOE Complex has thousands of buildings constructed before 1980, assuming that a building has asbestos and including it in the pre-job Hazards Analysis is a prudent approach to mitigating worker exposure.

By law, employers must establish regulated areas wherever airborne concentrations of asbestos or PACM are in excess of a calculated time-weighted average (TWA) or excursion limit. They must also demarcate the regulated areas, limit access, provide respirators, and require that everyone entering a regulated area wear a respirator (see 29 CFR 1926.1101). Willful violation of these requirements was evidenced August 12, 2004, when four Savannah River Site security employees entered an area posted with an asbestos warning and a "No Entry" sign to retrieve equipment. The Protective Forces General Manager has ordered a special investigation. (ORPS Report SR--WSIS-SECFOR-2004-0002)

Three of four recent ORPS reports that were related to potential asbestos exposures occurred because of inadequate work planning; the fourth was the result of a documentation issue. These events are described below.

On July 28, 2004, seven Kansas City Plant contract workers were potentially exposed to asbestos when they drilled to enlarge an existing opening for a vent line and scattered airborne debris. After they completed the work, they expressed concern about the white powdery debris. (ORPS Report ALO-KC-AS-KCP-2004-0022)

A sample sent for analysis indicated that the material contained 7 percent asbestos. Based on limited data, laboratory analysis personnel estimated that the workers may have received an exposure in excess of the exposure limits set by the American Conference of Governmental Industrial Hygienists. Tests were not performed in this facility before work was started, and because the Work Package did not include information about a potential asbestos hazard, the workers were not protected from asbestos inhalation.

All parts of a system must be sampled for asbestos, as demonstrated by a July 23, 2004, event at Lawrence Livermore National Laboratory involving the removal and replacement of an air conditioning unit. Laboratory employees performed abatement of the known ACM identified in the project scope in the first phase of the task. The second phase involved having a subcontractor remove and replace the air conditioning unit. Since it was believed that all ACM had been identified and removed in the first phase, asbestos removal was excluded from the contract. The subcontractor workers cut flexible fabric material between the

ducting sections, which were not identified in the previous abatement scope, and disposed of it in a designated roll-off container. An industrial hygienist noticed the material in the roll-off bin and suspected that it contained asbestos. The material tested positive for nonfriable asbestos (i.e., could not easily be pulverized or reduced to a powder). The four employees who removed the ductwork were not wearing respiratory protection, but air samples confirmed that loose asbestos contamination was not present in the room where the work took place. (ORPS Report OAK--LLNL-LLNL-2004-0029)

On July 16, 2004, at Los Alamos National Laboratory (LANL), workers encountered unexpected asbestos in an occupied office building when they removed and exposed linoleum sheet flooring attached to the plywood subfloor. The work crew did not suspect ACM because the building had been built after 1980 and because they were unaware that linoleum could contain asbestos. An industrial hygienist recognized the possibility that ACM could be present and submitted samples of the linoleum for testing. When a positive asbestos result was received, work was stopped, and LANL management reported the violation to the New Mexico Environment Department.

Advance planning prevented personnel exposures on July 15, 2004, during activities at the Hanford Site to cut, package, and stage abandoned fuel lines coated with nonfriable asbestos weatherproofing. Because asbestos was expected, cutting was performed by remote shearing equipment. However, a required Asbestos Competent Person was not present when the piping was wrapped for disposal. In addition, the workers failed to set up a marked boundary around the asbestos work area, as the Asbestos Management Plan requires (although a 75-foot safety area was in place to protect workers from flying debris). This event illustrates that even if worker safety is addressed, administrative and procedural requirements must be followed as well. (ORPS Report RL--BHI-DND-2004-0009)

Neither the 1970 Clean Air Act nor the 1989 Environmental Protection Agency (EPA) ban on the manufacture, importation, and processing of asbestos-containing products guaranteed ACM's elimination. As a result, ACM continued to make its way into construction materials. The First Court of Appeals remanded much of the original Rule in 1991, so the ban on many asbestos-containing products did not remain in effect. As a result, the assumption that building date or tile size is a credible criterion to determine the presence of asbestos is wrong on both counts: the prudent consumer or worker must refer to Material Safety Data Sheets (MSDSs) when they are available and must always exercise caution when encountering materials of unknown composition.

Additional information about ACM is available on the OSHA web site (http://www.osha.gov). Information is also available from the American Lung Association and on the EPA web site (http://www.epa.gov).

Products That May Contain ACM

Asbestos may be found in a variety of products during renovation and D&D work, including the following.

- Asphalt and vinyl floor tile of any size
- Ceiling tiles and lay-in panels
- Sprayed-on and blown-in insulation
- Electrical wiring insulation, electrical cloth, panel partitions
- HVAC duct, boiler, and pipe insulation
- Cement pipes, wallboard, siding
- Heating and electrical ducts
- Ductwork flexible fabric connections
- Spackling compounds, thermal taping compounds, packing materials for wall or floor penetrations
- Wallboard, chalkboards
- Roofing shingles and felt
- Fireproofing materials, fire blankets and curtains, fire doors
- Laboratory gloves, hoods, tabletops
- Cooling towers

(Source: U.S. EPA 2/5/04)

These events demonstrate the importance of anticipating the potential for discovering ACM during D&D activities and renovation work (i.e. any work that disturbs existing construction or infrastructure). Not only should D&D work planners consider the potential for ACM, but workers must understand that asbestos is neither rare nor a thing of the past — it can be encountered in a variety of places. Because of the subtle dangers of asbestos, workers should take all necessary precautions, never letting process knowledge or assumptions (e.g., building date or tile size) drive the work. In addition, an up-to-date analysis should be performed on materials sampled in the past.

KEYWORDS: *Asbestos, linoleum, ACM, PACM, insulation*

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

3. HELICOPTER ACCIDENT PROMPTS INVESTIGATION

On August 17, 2004, a Bonneville Power Administration (BPA) helicopter pilot lost control of his helicopter while stringing transmission power lines and crashed. Nearby BPA workers rushed to the crash site, pulled the pilot from the wreckage, and attempted to revive him using cardiopulmonary resuscitation. Paramedics arrived soon afterward, attempted to treat the pilot, and activated the fuel cutoff switch to prevent the jet fuel on board from causing a brush fire. The pilot was pronounced dead at the scene. The Federal Aviation Administration (FAA) is investigating the accident. (Not reported in ORPS)

The pilot, with 29 years of service at BPA, was flying a 1994 Bell Jet Ranger (Figure 3-1) when it crashed in a field. FAA inspectors' preliminary findings indicate that the helicopter was pulling rope for installing a static wire at the top of 220-foot-high towers supporting a 500-kV power line. A reel machine operator played out rope from a truck-mounted machine on the ground,

Figure 3-1. Accident scene

and the rope was attached to the helicopter's cargo hook. The reel machine operator stated that he saw the adjacent turn of line cross over the outfeed line, which caused the line to begin rewinding on the reel.

The reel machine operator immediately disengaged the machine's spooling mechanism, but the rope between the reel and the helicopter had already pulled taut. About 20 members of the work crew installing the wires witnessed the accident and reported that when the rope went taut, the helicopter pitched up and rolled right. The helicopter fell approximately 200 feet to the ground and landed on its right side.

Pertinent lessons learned and corrective actions will be reported in a future issue of the *OE Summary*.

4. PNNL RE-EXAMINES LABORATORY SAFETY PERFORMANCE FOLLOWING NEAR MISS

A recent accident at the Pacific Northwest National Laboratory (PNNL) involving a pressurized tube that split and sprayed caustic waste into a room has compelled the Laboratory to examine its safety procedures and mechanisms. The following is a summary of the accident and the actions taken after it occurred.

On April 15, 2004, waste operations personnel were using a peristaltic pump to move caustic liquid from waste containers into a 55-gallon drum when the flexible tubing used inside the pump burst, spraying approximately 500 ml of

Figure 4-1. The pump shortly after the accident

liquid into the room (Figure 4-1). A support staff member tried to turn off the pump and was sprayed with a small quantity of the liquid. He suffered first-degree chemical burns on his face and arms. One of the technicians working in a fume hood was sprayed in the face with a few drops of the liquid. He quickly wiped his face with a damp towel and was not burned or injured. (ORPS Report RL--PNNL-PNNLNUCL-2004-0004; final report filed August 6, 2004)

Five people were in the room when the accident occurred: two in the fume hood, two providing general support, and one radiological control technician. The staff members working in the fume hood wore lab coats, goggles, and chemical gloves; the other staff members wore street clothes and safety glasses with side shields. The liquid, designed to simulate Hanford Tank Farms waste, consisted of an aqueous solution of 12.75 percent sodium hydroxide, nitrates, and tracer levels of cesium-137.

The waste containers and drum were contained within a fume hood, with the pump just outside of the hood. The support staff member noticed that the pump was vibrating, attempted to turn it off, and was sprayed in the face. He rinsed his face at an eyewash station near the pump. When the technician working in the fume hood turned off the pump, a few drops of waste splashed his face, and he wiped them away.

Investigators determined that the most likely cause for the tube rupture was a combination of an obstructed quick-disconnect fitting (Figure 4-2) on the outlet side of the pump and increased backpressure caused by a higher than normal occlusion setting on the pump. Paper debris had clogged the quick-disconnect fittings (most likely pH paper or pieces of container labeling) when it was drawn in from the bottom of the waste containers. The paper accumulated during the transfer process and eventually blocked the fitting completely.

Figure 4-3 shows a microscopic image of the ruptured tube. The investigation revealed that the following work planning deficiencies contributed to this accident.

- The staff did not hold a pre-job meeting to discuss personal protective equipment (PPE) requirements or each member's roles and responsibilities. This prevented them from identifying and applying work controls for working with caustic material.
- The staff members did not read the manufacturer's operating manual before using the peristaltic pump.
- The safety subject matter expert reviewed the transfer procedure, but did not review the operation.
- The pump was not in an enclosure, which would have contained the spray from the ruptured tube.

Figure 4-2. Clogged quick-disconnect fitting

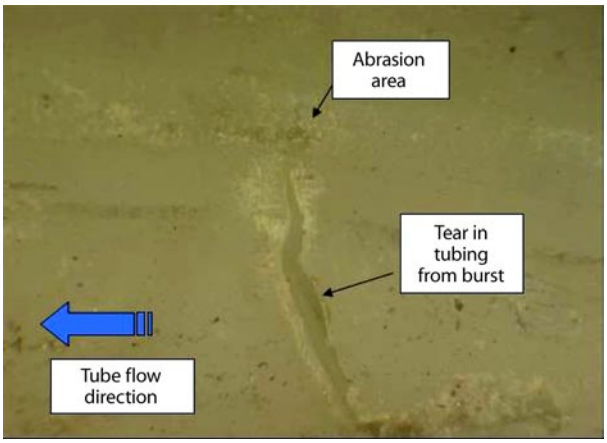

Figure 4-3. Microscope image of the ruptured tube

- The remote shutoff switch was in a position that forced support staff to reach toward the pump to shut it down. When the staff member heard the pump vibrating, he had to get close to the pump to turn it off, placing himself in the spray path. Changing the location of the remote switch would have reduced the probability of being sprayed.

- The staff members wore PPE that was inadequate to protect them from the splashing liquid.

- The site procedure for radioactive liquid waste transfers did not address staff roles or PPE and did not specifically describe transfers by pumping, siphoning, or pouring.

PNNL's Independent Oversight Group issued its investigation report in June 2004, and the Laboratory's lessons learned organization issued a document entitled *Planning is Key* in July 2004. The Deputy Laboratory Director for Operations then asked the Independent Oversight Group to perform a trending analysis of near-miss events over the past several years to identify commonalities and failure modes so that management could make programmatic improvements and prevent future events.

The group reviewed 15 near misses, mostly in the research and development sector, related to electrical events, fires, and overpressurizations that have taken place over the past 4 years. The group also interviewed PNNL and DOE staff, searched for related research articles, and reviewed two previous trending reports.

The group's investigation revealed common threads among all 15 events, including the following.

- Most of the staff involved were experienced.

- Baseline hazards were not clearly identified and documented.

- Most of the events involved an energetic system in which the original conditions had changed and new hazards were not recognized.

- Most process changes were made the same day as the event and did not include oversight or review by a safety and health subject matter expert, peer, cognizant space manager, or line manager.

PNNL has undertaken initiatives in the past few months to address the safety and health concerns that were identified. The following is a brief summary of the initiatives.

- Developing a comprehensive safety and health improvement plan;

- Implementing a program to improve worker safety and health awareness;

- Developing a line management training program that focuses on safety and health;

- Developing hazard awareness training;

- Making line management more accountable for safety initiatives;

- Developing an experimental authorization form to inform cognizant space managers of the processes and potential hazards that will be in their assigned spaces;

- Targeting corrective actions to enhance trending of events; and

- Developing a new safety tool in which staff asks safety-specific questions such as "What's the worst thing that can happen?" and "How can I prevent that from happening?" before starting work.

The event at PNNL and the actions the Laboratory took afterward illustrate the importance of using previous experience to prevent future adverse events. Corrective actions developed in response to an event should not only address problems related to the event, but should also target root causes to prevent recurrence.

KEYWORDS: *Peristaltic pump, near miss, tubing, caustic, injury, work planning, lessons learned*

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

Commonly Used Acronyms and Initialisms

Agencies/Organizations	
ACGIH	American Conference of Governmental Industrial Hygienists
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 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
ORPS	Occurrence Reporting and Processing System
PPE	Personal Protective Equipment
QA/QC	Quality Assurance/Quality Control