OPERATING EXPERIENCE SUMMARY

Inside This Issue

U.S. Department of Energy

Office of Environment, Safety and Health

OE Summary 2004-21

November 1, 2004

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. *LEAD EXPOSURE — A CONTINUING DANGER*

Lead exposure is a leading cause of workplace illness, according to OSHA. In the first 10 months of this year, five events involving worker lead exposures during normal operations were reported in ORPS.

On September 29, 2004, at Oak Ridge National Laboratory, a leadburner and pipefitter cutting sheets of lead with a radial arm saw were exposed to airborne lead. The saw was equipped with a high-efficiency particulate air (HEPA) filter that operated when the saw was running to capture lead dust at the blade. The pipefitter used a foxtail brush to sweep lead shavings off the table and placed them in a melting pot. When they finished working, dust spots were observed on the respirator filters of both workers. (ORPS Report ORO--ORNL-X10EAST-2004-0010)

The respirator filters were immediately sent to the lab for analysis, and sampling results indicated that the workers had exceeded the OSHA time-weighted average (TWA) for lead. Although tests continue, preliminary estimates are that the air flow through the HEPA filter was less than adequate and allowed airborne lead to reach the workers' respirators. Use of the radial arm saw was stopped.

On May 18, 2004, at the Kansas City Plant, data indicated that airborne lead was present during quarterly lead decontamination of the firing range. The operation involved cleaning the range floor, walls, baffles, and HEPA filters; vacuuming residue; and emptying bullet collection trays. Because the ammunition is lead-based, workers were wearing personal protection equipment (PPE), including dermal and full-face respiratory protection. Data received from personal samples determined that the Permissible Exposure Limit (PEL) was exceeded. (ORPS Report ALO-KC-AS-KCP-2004-0020)

The cleaning previously took place monthly but had been reduced to quarterly cleanings to reduce potential exposures. In response to this event, more efficient HEPA vacuum attachments

Lead Fact Sheet

- Lead can be found in some folk remedies, health foods, and cosmetics.
- Certain hobbies use products with lead in them (fishing sinkers, stained glass, ceramics).
- Lead crystal and china should not be used to store food or beverages. If alcoholic beverages or acidic substances are left in these containers for longer than a few hours, there is a risk that the lead could leach into the liquid.
- Lead exposure from drinking water is primarily due to the presence of lead in pipes or solder. Run water for several minutes before drinking; replace pipes if possible.
- Past use of leaded gasoline contributed greatly to the number of cases of childhood lead poisoning in the U.S. during the last sixty years or so. The lead produced by vehicle emissions continues even today to present a hazard, as much of that lead now remains in soil where it was deposited over the years, especially near well-traveled roads and highways.
- Tests have shown that lead has a negative effect on male fertility, causes spontaneous abortion in pregnant women, and causes toxic effects on the human fetus. Other health effects include muscle and joint pain, irritability, memory or concentration problems, damage to the gastrointestinal and nervous systems, the kidneys, and blood pressure.
- Although human studies are inconclusive regarding lead exposure and increased cancer risk, the EPA considers lead to be a "Group B2, possible human carcinogen."
- Occupations related to house painting, welding, renovation and remodeling activities, smelters, firing ranges, and the manufacture and disposal of car batteries are more likely to expose workers to lead.

Sources: EPA, National Safety Council, Centers for Disease Control were ordered. In the future, no cleaning method or tool that causes dust (e.g., brooms) will be used. Blood tests on the workers were within normal limits.

On February 27, 2004, at Lawrence Berkeley Laboratory, air samples for two workers torch-cutting structural steel at ground level were above the PEL for lead. Previous ongoing air sampling results at the work site, which were well below the PEL, had been the basis for the current respiratory requirements. Based on this event, requirements were upgraded to provide a higher protection factor during hot cutting. Subsequent monitoring results after the occurrence have all been below the PEL. (ORPS Report OAK--LBL-OPERATIONS-2004-0002)

On February 6, 2004, at Oak Ridge National Laboratory, two cable splicers working in a manhole on a 2-day job to repair an electrical fault on a feeder exceeded the PEL on both days. Workers performing cable splicing in electrical manholes are required to wear half-face respirators. The workers had cut and filed lead components in an enclosed space without respirators; however, they were wearing breathing zone monitoring (sampling pumps and filter cartridges). The monitoring test results indicated a high level of lead. Both workers were sent to Health Services for blood lead level tests, which indicated that their levels were below the action level of 40 micrograms per deciliter (mcg/dl). (ORPS Report ORO--BJC-25GENLAN-2004-0002)

Related lead exposure events during underground cable splicing at Oak Ridge were documented in earlier ORPS reports (ORO--BJC-K25GENLAN-2001-0014 and ORO--BJC-K25GENLAN-2002-0002). The corrective actions resulting from those events included adding a requirement for respiratory protection to the Activity Hazard Assessment and disseminating the new requirement to the workers in a letter, which they acknowledged by their signatures. Inexplicably, the workers involved in this incident had been observed wearing the correct PPE during other evolutions, but in this instance, both their attitude and ability to perform work safely were less than adequate.

The final example does not involve lead exposure, but is a good example of an as-found condition of concern. On January 7, 2004, at Argonne National Laboratory-West, grit was found with higher-than-expected levels of lead from nearby paint sandblasting. The RCRA-permitted outdoor Radioactive Sodium Storage Facility was being cleaned in preparation for closure. Samples of sandy material removed from the facility's asphalt surface and the area surrounding it showed lead concentrations high enough to make the sandy material a RCRA-controlled hazardous waste. (ORPS Report CH-AA-ANLW-ANLW-2003-0001)

Investigators determined that the lead contamination probably came from an outdoor blasting area nearby, where equipment with painted surfaces had been stripped. Although lead-based paint has not been used at the site since the Consumer Products Safety Commission banned its use in 1978, investigators confirmed that some older painted items (e.g., spreader bars) had been painted with lead-based paint. These items were blasted in the area in 2003, and it is likely that winds carried the lead-contaminated grit onto the asphalt pad. The released lead level is well below residential soil exposure limits, according to the Idaho Department of Environmental Quality, but the event acts as an effective cautionary tale, nonetheless.

By law (29 CFR 1910.1025 and 29 CFR 1926.62), employers must establish regulated areas, work practices, and engineered controls for work where lead exposure is possible; must require respiratory protection where those controls may be insufficient; must ensure (through monitoring) that workers are not exposed to lead above certain concentrations; and must use a formula (the time weighted average, or TWA) to calculate permissible exposure.

According to the EPA and OSHA, lead is most commonly used in battery manufacture, but is also used in the production of sheet lead, solder, pipes, ammunition, cable covering, and paint (because it increases corrosion resistance).

These events demonstrate the importance of expecting the unexpected and careful work planning that includes a variety of possible hazards. Industrial hygienists and work planners need to consider that uncertainties surrounding contamination levels, which could be encountered during work, should *dictate highly conservative approaches to work planning and the selection and use of respiratory protection equipment.*

KEYWORDS: *Lead, paint, PEL, TWA*

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

2. WORK PLANNING AND COMMUNICATION ISSUES IDENTIFIED IN TYPE B ACCIDENT INVESTIGATION

On August 25, 2004, at the Waste Isolation Pilot Plant (WIPP), an underground worker suffered a severe blunt-trauma head injury and scalp lacerations when his hard hat was struck by a large metal C-clamp. The clamp attached a nylon rope to a ventilation line that was being hauled out of a drift (an underground opening that underground workers use for moving equipment and materials). The clamp, which was under tension from the rope, became a missile when it pulled free of the ventilation line. The Carlsbad Field Office Manager initiated a Type B accident investigation shortly after the worker was released from the hospital the following day. (ORPS Report ALO--WTS-WIPP-2004-0011)

The injured worker was part of a team that was tasked with cleaning out the drift (shown in Figure 2-1), which had been unused for 10 years. The work scope included removing stockpiled muck, ventilating the drift, evaluating and repairing roof beams, and retrieving abandoned materials and equipment.

Two weeks before, facility managers met and discussed the feasibility of incorporating elements of this work package with Mine Safety and Health Administration (MSHA)-required underground mine rescue team training. The Carlsbad Field Office was not informed about this meeting or its purpose.

The management group decided to permit a mine rescue training team to enter the drift and remove compressed-gas cylinders before the remainder of the work continued. This task was approved on the conditions that underground personnel first evaluate ground conditions and air quality for safety and that the work package include a safety briefing and hazard analysis.

The work package described hazards from rotating equipment, noise, and ground control, but did not mention moving the vent lines or the

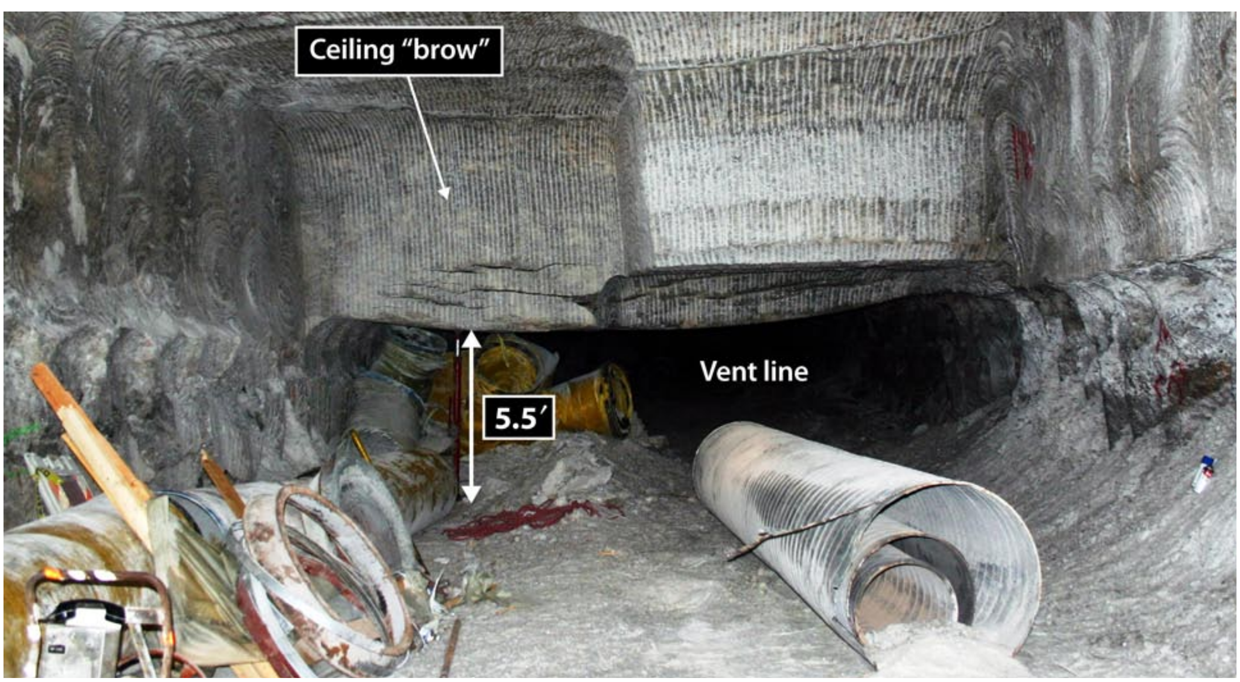

Figure 2-1. Vent pipe in the drift

equipment to use. Workers interviewed after the accident stated that they had experience in moving fiberglass vent lines, which are equipped with handles and weigh about 140 pounds, but not in moving metal vent lines, which weigh about 460 pounds.

One step of the work order stated that the removal and disposal of abandoned materials and equipment was to be performed "in accordance to approved WIPP procedures." It did not identify specific safety analysis sheets or applicable procedures for securing or removing the old equipment, including the metal vent line.

The work package, which was reviewed and approved on August 24, failed to identify other hazards that might be encountered. Also, the pre-job walkdown did not include the area under the brow (the point where the ceiling steps down to the lower level where the old equipment was located).

The pre-job safety briefing, however, did identify one additional hazard — heavy lifting for moving vent lines — and directed workers to "use proper lifting practices, use mobile equipment when possible–more man power if needed."

After removing the gas cylinders and a brattice (ventilation) bulkhead from under the brow, team members removed several sections of fiberglass vent line by hand. They also removed a section of metal vent line, but experienced some difficulty.

To remove the next piece of vent line, the team attached a ½-inch nylon rope and some pipe wrenches that they used as handles to a Kubota tractor. The pipe wrenches proved to be ineffective, so they decided to punch a hole in the vent line and attach a C-clamp (Figure 2-2) to the rope to pull the line out of the drift. They found that the line dug into the floor as it was being pulled and that it was difficult to maintain the line's traction in the uneven, loose salt surface.

Without stopping work or re-evaluating the hazards, they decided to substitute a load dump hauler, a much larger and more powerful vehicle

Figure 2-2. C-clamp attached to vent line

than the Kubota tractor. They also nested two smaller pieces of vent line inside the original piece to speed up the job. The combined weight of these pieces was estimated to be about 900 pounds.

As the hauler pulled the vent line, one of the workers noticed that the clamp was tearing the line and called to the hauler operator to stop. The operator, however, was moving in reverse and did not see the worker. The 5½-pound C-clamp pulled out of the line with sufficient force to fracture the hard hat and safety glasses of the worker, who was 65 feet away, and to propel the clamp another 85 feet behind him.

After he was hit, the worker fell to the ground but remained conscious and alert. Emergency medical responders transported him to Carlsbad, where he was evaluated and airlifted to Lubbock, Texas. The worker was treated and released from the hospital the next day.

Following the accident, the team stopped work and discussed the accident at a safety meeting. The accident scene was secured so that the Board could commence its investigation.

The Board concluded that the root causes for this accident were that work planning for moving vent lines was less than adequate and that the workers proceeded to work without the proper tools, equipment, methods, and conditions needed to complete the job safely. Using the root and contributing causal analyses, the Board identified the following Judgments of Need that the managing and operating contractor, Washington TRU Solutions (WTS), needs to address to prevent future similar events.

- Establish a program to provide a formal Person-In-Charge or equivalent to ensure that safe work practices accomplish work package objectives.
- Strengthen the integrated safety management program to identify the scope of work, analyze the hazards, plan, control, and conduct work safely, and effectively address improvement opportunities when developing work packages.
- Better communicate work scopes that involve multiple work groups.
- Focus management attention on identifying hazards and evaluating work performance at the activity level.
- Assess the effectiveness of hazard recognition and accident prevention training.
- Ensure that training requirements comply with 30 CFR 49.8, *Training for Mine Rescue Teams*, as prescribed by MSHA.

This event illustrates the importance of developing complete work packages in the planning phase. Work packages should specify each task, identify who will perform the work, and indicate what type of equipment will be needed to perform the job safely. If there is any doubt, work should stop. Also, substitutes or makeshift equipment must be approved by a subject matter expert or engineer before use.

KEYWORDS: *Injury, Type B, work planning, hazard identification, underground*

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

3. INDUCED VOLTAGE FATAL TO ELECTRICAL LINEMAN

On June 7, 2004, a 20-year-old apprentice lineman working for a contractor of the Western Area Power Administration was electrocuted by induced voltage while working on a transmission line construction project east of Watertown, South Dakota. The lineman was transported by ambulance to a hospital where he was pronounced dead on arrival. Western's Chief Operating Officer appointed a Type A Accident Investigation Board to investigate the cause of the accident. (Not reported in ORPS)

The victim, assisting as an apprentice lineman, had spent the afternoon removing personal grounds at different structure (tower) locations on a de-energized 230-kV power line. Later in the evening, the victim and another apprentice, along with a groundman and a superintendent, went to assist a four-man crew in removing the last of the protective grounds. The other crew consisted of an experienced foreman, journeyman lineman, and two apprentices.

After directing the two apprentices (the victim and one other) to help remove the grounds, the superintendent and foreman left the area. The victim climbed the transmission tower and moved to the ground lead attachment point on the "B" phase crossarm (Figure 3-1). When he got into position, instead of attaching the snap hook (Figure 3-2) of his fall arrest lanyard to the structure, he attached it to the eyebolt of the ground lead clamp (Figure 3-3) and used it as a tool to remove the clamp. The apprentice then removed the "cold" end of a protective ground out of the prescribed sequence and was electrically shocked numerous times before the journeyman lineman could move the loose ground end a safe distance away with a hot stick.

The Board determined that removing the cold end of the protective ground while the "hot" end of the ground was still connected to the "A" phase conductor was the direct cause of the accident. This condition placed the apprentice lineman in series with a circuit that was energized by induction. The current on the ground cable was calculated at 1,400 milliamps, well above lethal levels (50 milliamps or greater).

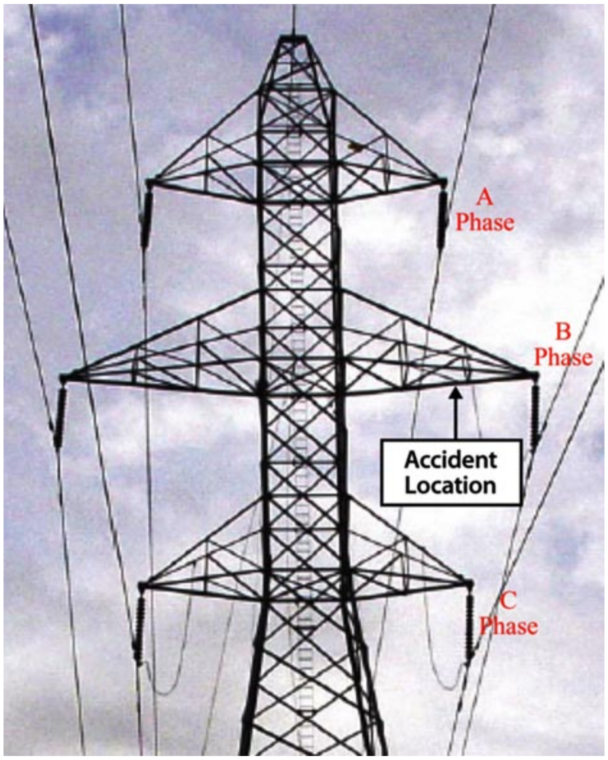

Figure 3-1. Transmission tower involved in the accident

Figure 3-2. Lanyard snap hook showing burn marks

Figure 3-3. "Cold-end" clamp of the ground cable that was attached to the tower

The Board's review of personnel classifications showed that contractor crew members who started to remove grounds at this tower had adequate training and experience to perform the work safely. However, when the crew was restructured to include one journeyman, four apprentices, and one groundman and was without supervision, its competence to safely complete the job was compromised.

The victim had limited experience in high-voltage line work and had been certified by his employer as a qualified climber for this specific project. On the day of the accident, the apprentice had been assisting in removing the cold-end ground leads only after a journeyman had removed the conductor lead with a hot stick and transferred them to the ground on a tag line.

The Board identified the following contributing causes.

Inadequate Job Planning — Pre-job planning was inadequate because the hazards and mitigation measures were not identified in a project-specific stringing and grounding plan.

Knowledge and Experience — Considering the victim's training and work history, as well as incorrect application of fall protection equipment, the lineman should have been climbing and removing grounds only under direct supervision of a foreman.

Job Hazard Analysis (JHA) — A JHA would have addressed the use of apprentice linemen, induced voltage, fall protection, and safe sequence for removing grounds.

Designating/Directing Work Crews — Line management and supervisors must identify the necessary knowledge and skills to prevent unsafe work conditions. When the work crew was reduced in number and in experience level, the need for direction and oversight was disregarded.

Lack of Supervision — The decision of the superintendent and foreman to leave the job site before the crew removed the grounds was wrong. There was no control of the work site to ensure the safe work practice of the apprentice linemen.

Lack of Responsibility for Own Safety — The apprentice proceeded to remove grounds without communicating with the journeyman, and he disregarded proper fall protection requirements by using the lanyard snap hook as a tool to remove the ground end.

Inadequate Implementation and Enforcement of Contractor's Safety and Health Plan — The superintendent did not adequately enforce the safety plan to ensure a qualified work crew, foreman oversight, proper fall protection measures, and specific instructions for removing grounds.

A similar event occurred on April 25, 1997, when a Bonneville Power Authority subcontract lineman was electrocuted when he came in direct contact with a de-energized 230-kV transmission line conductor that contained induced voltage. A 287-kV line operating at 300 kV ran parallel to the line on which the fatal accident occurred. Accident investigators determined that the conductor may have had an induced voltage of 4 kV from coupling with the energized line. When the lineman attached the ground to the conductor, over 125 milliamps flowed through his body. The accident occurred while the lineman was attempting to remove a gripper from the conductor while standing in a lift basket. A reenactment of the accident is shown in Figure 3-4.

Investigators found that the portable protective grounds were not properly secured at the ground clamp end and that the lineman's personal ground may not have been in place. They also found no evidence that the lineman had been trained on parallel line induction and other hazards associated with high-voltage transmission lines.

Figure 3-4. Reenactment of lineman removing gripper from conductor

In 2002, a non-DOE fatal accident happened in Tennessee when a worker in an elevated basket came in contact with an ungrounded incoming power line that was energized by induced voltage from a nearby 500-kV conductor. The accident could have been avoided if the grounds had been left in place until all substation work had been completed.

The Director of Safety and Health for the International Brotherhood of Electrical Workers stated that many recent power line accidents can be traced to two problems: induced voltage and removal of grounds in an improper sequence. Workers often assume that a grounded line is dead, but having a grounded circuit is not enough to guarantee safety.

Workers need to understand that a de-energized line can become energized from the induced voltage of a nearby energized circuit. The magnitude of the induced voltages depends on the proximity of the two lines, the distance the lines run parallel, and how many megawatts the energized line is carrying.

These events illustrate the importance of ensuring that linemen and electricians are trained on safe grounding and bonding procedures. Safety manuals should provide guidance on induced voltage and workers need to understand the risks of induced voltage and how it can occur. It is also important that electrical workers have the required experience levels to perform assigned work and that they are properly supervised while on the job.

KEYWORDS: *Electrical safety, shock, electrocution, fatality, procedure, protective ground, induced voltage*

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

4. UNSAFE LADDER USAGE CONTINUES TO CAUSE FALL INJURIES

According to the Bureau of Labor Statistics (BLS), 2,800 non-fatal ladder injury events and 100 fatal events occurred at U.S. construction-related sites between 1992 and 2002. Numerous injury accidents resulting from ladder falls and ladder misuse have also occurred across the DOE Complex. Since 2000, 26 events involving ladders have been reported to ORPS; 16 of these involved fall injuries resulting from unsafe use of ladders or improper work performance around ladders. Some of these events resulted in DOE Type A and B accident investigations.

On August 3, 2004, at the Oak Ridge National Laboratory Central Complex, a worker broke his wrist when he fell from a ladder while helping install a control valve on air handling equipment. The worker misjudged his position on the 8-foot fiberglass stepladder and believed he was descending from the first rung when he was actually on the second rung. The incident occurred only days after ladder safety had been discussed at a regular tool box safety meeting. (ORPS Report ORO--ORNL-X10CENTRAL-2004-0012; final report filed August 13, 2004)

Corrective actions included revising the Activity Hazard Analysis to adequately define hazards and controls associated with conducting work while on a ladder and scheduling ladder refresher training. Supervisors also met with workers and emphasized the importance of attentiveness to work and job location when performing a task or changing tasks.

Fall injuries often occur when workers carry materials or equipment while on a ladder. On February 28, 2004, at Argonne National Laboratory, a mechanic performing routine maintenance work on a Heating, Ventilation, and Air Conditioning (HVAC) system fell from a ladder and fractured his ankle. The worker was carrying a 6-foot section of duct work while he was on the ladder, in violation of procedures. In addition, the worker did not have three-point contact on the ladder because his attention was focused on removing the duct work section without damaging the suspended ceiling. The mechanic was returned to duty with no restrictions, but he was required to review established ladder safety procedures and requirements. (ORPS Report CH-AA-ANLE-ANLEPFS-2004-0004; final report filed May 14, 2004)

Causes of Ladder Fall Injuries Reported to ORPS

- Forgetting rung position on the ladder while descending
- Carrying materials while ascending or descending ladders
- Climbing without 3-points of contact on the ladder
- Losing footing
- Choosing the wrong ladder for a task
- Not securing the ladder base to prevent shifting
- Positioning the ladder on unstable surfaces
- Working outside the ladder footprint
- Not paying attention when working around fixed ladders and fixed ladder openings

Another fall injury event involving a worker carrying equipment while on a ladder occurred on April 21, 2004, at the Stanford Linear Accelerator Center. In that incident, a worker was struck by a falling coil of cable when a second worker standing higher up on the ladder dropped one of three coils of cable with splice enclosures while passing them to another worker above him. The worker violated site ladder safety policy by carrying the coil over his shoulder as he ascended the ladder. He also put himself at risk by handing cables up to his co-worker while standing on the ladder and by climbing the ladder with cables strung over his shoulder. (ORPS Report OAK--SU-SLAC-2004-0003; final report filed May 14, 2004)

A review of ladder safety events by the Office of Environment, Safety and Health for the period 2000 through August 2004 shows that more ladder events occurred in 2003 and 2004 than in the 3 previous years. In addition, 75 percent of these events involved the use of portable ladders rather than fixed ladders.

Data from BLS also indicates a much greater incidence of falls and injuries involving movable (portable) ladders. Portable ladders are used by many types of workers for a multitude of tasks. Ladders are handy and simple to use, but workers sometimes forget to use them safely. Accident prevention requires proper planning, correct ladder selection, adequate ladder maintenance, and application of safe ladder work practices.

OE Summary 2004-09 discusses the April 21 event and provides information on using ladders safely. Specific citations on ladder safety from Subpart X of 29 CFR 1926, the OSHA Standard for Construction, are also included in the article. A lessons-learned report entitled *DOE Complex Ladder Injury Incidents* was published to SELLS on October 18, 2004. The report includes a summary of several events that occurred in 2003 and 2004 and includes recommended actions for safe ladder use. (SELLS Identifier 2004-SR-WSRC-0049)

Safe Ladder Setup and Use

- Place ladders on clean, slip-free level surfaces.
- Extend the ladder at least 3 feet above the top support or work area.
- Anchor the top of the ladder to a solid point or have the bottom of the ladder attended by another worker.
- Place the base of the ladder ¼ the height of the ladder from the wall when using an extension ladder (e.g., the feet of a 20-foot ladder should be 5 feet from the base of the wall).
- Never allow more than one person on a ladder at a time.
- Use carriers and tool belts to carry objects up a ladder.
- Do not lean out from the ladder. Work within the footprint of the ladder by keeping your waist inside the side rails.
- Don't allow others to work under a ladder while it is in use.
- Don't climb a ladder if you have a fear of heights.

These events indicate that workers must take appropriate safety precautions when using ladders and must pay attention both to tasks and task locations when working on ladders. Supervisors should communicate the necessity for workers to follow the ladder safety procedures and ensure that they understand and follow them.

KEYWORDS: *Ladder, injuries, falls*

ISM CORE FUNCTIONS: *Analyze the Hazards, Perform Work within Controls*

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